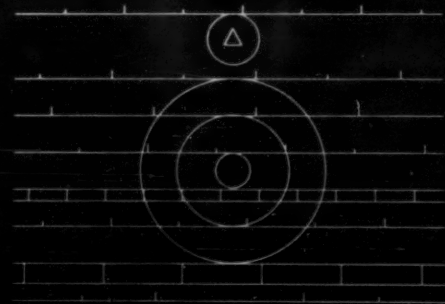


Design News



Edge-lighted instrument panels. Page 8

A ROGERS PUBLICATION

FEBRUARY 13, 1961

NATIONAL OIL SEAL LOGBOOK

Ask yourself these questions when specifying oil seals

SHAFT RPM, FPM, RUNOUT, ENDPLAY	Is seal rated at or above my anticipated operating extremes? <input type="checkbox"/> YES <input type="checkbox"/> NO
TEMPERATURE, LUBRICANT TYPES	Will heat or special-purpose lubricants attack my sealing lip compounds? <input type="checkbox"/> YES <input type="checkbox"/> NO
PRESENCE OF DIRT OR OTHER FOREIGN MATERIAL	Point often overlooked. If present, should I specify dual-lip sealing member? <input type="checkbox"/> YES <input type="checkbox"/> NO
COST RELATED TO SEAL DESIGN	Will a simpler, less expensive seal do as good a job as a more sophisticated unit? <input type="checkbox"/> YES <input type="checkbox"/> NO
NEW SEAL DESIGNS AND MATERIALS ON MARKET	Are there new high temperature, high speed compounds I should examine before specifying? <input type="checkbox"/> YES <input type="checkbox"/> NO
SPECIAL DESIGNS FOR SPECIAL PROBLEMS	Not all sealing jobs can be met with stock seals. Do I need a special factory design? <input type="checkbox"/> YES <input type="checkbox"/> NO
DELIVERY, REPUTATION FOR QUALITY	Is my resource noted for on-time delivery, uniform quality, and good follow-up service? <input type="checkbox"/> YES <input type="checkbox"/> NO

Don't specify "blind." Your National Oil Seal Engineer has up-to-date data on seals—old, new and under development. He understands current sealing parameters; what special designs can probably be developed. His frank, free counsel can't help but lead to better sealing, faster assembly, simpler servicing, faster delivery or lower cost.



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NBP February 13, 1961 **BPA**
Vol. 16 No. 4
Worldwide Coverage of Technical

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DESIGN NEWS

News and Engineering Ideas. More than 48,000 copies every other Monday.

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Pittsburgh 22, Pa.	1 Gateway Center.	ATlantic 1-8822
London, W.1, England.	16 Berkeley St.	Hyde Park 3392
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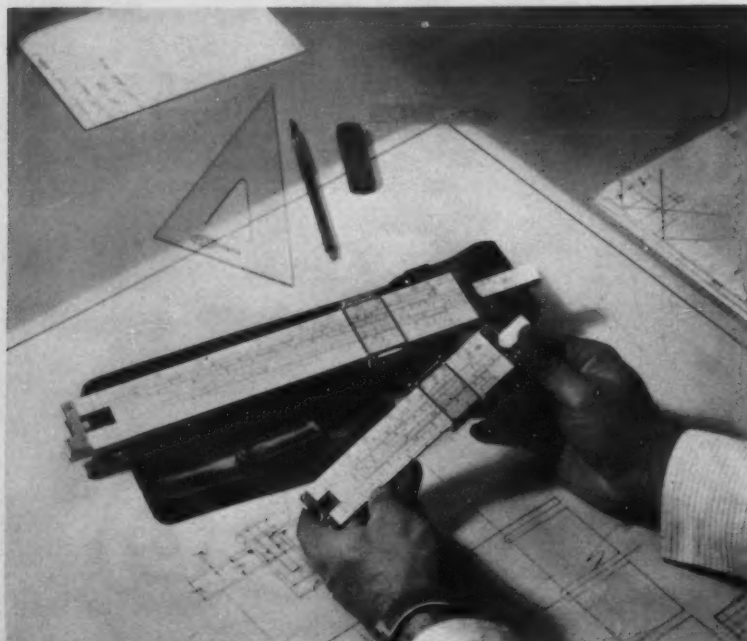
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DRAFTING TRENDS



This is a size comparison between the 10" POST Versalog and its 5" replica, the POST Pocket Versalog.

The trend to "COMPACT" slide rules

Why a small slide rule?

Users of America's best-selling Post Versalog, in the regulation 10" desk size, have been known to covet a 5" Post Pocket Versalog, and even buy one . . . as a more easily carried convenience . . . as a spare . . . or just for the sheer joy of having, like a gun collector, a "matched pair."

It took more than requests from pleased users of the 10" Versalog to convince our marketing people that the need actually existed for a premium-priced 5" pocket rule with 23 scales. Our technical men were even harder to convince that high Versalog standards of accuracy could be maintained in miniature.

Who can use them?

That there is a need has since been proved by the thousands of engineers, architects, scientists, and students who have bought and used a Post Pocket Versalog in preference not only to the larger version, but

after comparing it with other smaller makes.

As to accuracy, we are still amazed at the exquisite job our production team has done in miniaturization—the 5" Pocket Versalog includes every one of the 23 scales found on its much larger counterpart and, in addition, bears engine-divided calibrations of such sharpness and clarity that no magnifier is needed.

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To further popularize this fine instrument, Post dealers are offering it at a special low price for a limited time. All models come with a hand-crafted leather case and spring pocket clip. Also available with hard-bound instruction text.

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SOUNDING BOARD

FOR OUR READERS



Cost-Plus

This is a belated but deserving credit to your editorial of March 28, 1960, entitled "Cost-Plus".

There are indeed few more contradictory circumstances existing in our modern United States. Though accepted, as you say, under the guise of expediency, speed and efficiency, the net result of the absurd practice is exactly the opposite. This anecdote may be enlightening: The only place where a special mil-spec product was available locally for a contractor was on surplus shelves—where it had recently been stocked at two cents on the original contract dollar. It was offered for sale at five cents on the dollar. Nevertheless, the contractor insisted he be billed the full dollar price so that he would get his normal 10 percent markup.

Such practices are heart-rending misuses of your and my tax dollars. Though it could be labeled outright fraud, there are many legitimate excuses, for had the contractor been forced to order in the more costly manner directly from the factory supply, the normal cost would have been existent.

Unfortunately, I cannot agree with you that "there are indications that 'cost-plus thinking' is on its way out". If not this, there would be many other abuses perpetrated in our free and easy economy under the guise of "expediency".

SAMUEL L. LOVE

President

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HENRY J. VANCE

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At Variance with Facts

Your editorial, "Dead End Engineers", in the Nov. 21 issue of DESIGN NEWS expresses a view of the engineering profession in the United States at this time which is quite at variance with present-day facts.

Professional registration is by no means a farce with little or no stature. The facts are that every state in the union, the Canal Zone, District of Columbia, Puerto Rico and every province of Canada have registration boards; there are more than 250,000 registered engineers who have been licensed by these boards.

Industrial employers of engineers, the Department of Defense and other Federal Government departments, state and municipal authorities recognize the value of registration and are more and more requiring their engineering employees to become registered. Many courts of law do not recognize engineers as expert witnesses unless they are registered professional engineers. The role of the engineer as a professional employee is becoming increasingly emphasized.

While there is no one overall organization to represent the engineers, progress is being made to better coordinate the efforts of the leading engineering organizations to furnish this united voice. In the professional field, the National Society of Professional Engineers represents more than 65,000 engineers of all branches. The Engineers' Council for Professional Development is active in the educational field and the Engineers' Joint Council primarily in the technical field.

The inference from your comments on unionism and unionization of engineers is not very clear. More and more the employed engineers are finding that unions and professionalism do not mix.

The last few words of your editorial are, ". . . There are a lot of 'dead end' engineers." Is it not highly probable that these people are actually technicians rather than engineers? Unfortunately, many so-called engineers are not really engineers. If the engineer wants to be a true professional, it is up to him. No one can be recognized as such unless he earns it. I think that the majority of the engineers today have earned the right to be called professional engineers.

NOAH E. HULL

President

National Society of Professional Engineers

Foreign Iron Cost

In the "Seen and Heard" column of the Oct. 10, 1960, DESIGN NEWS, you asked a question about the premium price on foreign sports cars, ". . . Could it be the profit factor?"

If you check the factory price of such cars against their selling price at the U. S. port of embarkation, you can definitely see the effect of a "profit factor".

For example, the factory-delivered base price of a Triumph TR3 sports roadster is \$1900 (Coventry, England), while the New York POE price is \$2675. The 7 percent import duty amounts to \$133; transportation is about \$120 (if you shipped the car privately) and the importer takes \$45 per car for preparation charges. These expenses total \$288, leaving \$487 to be divided among the importer, distributor and dealer. An additional transportation charge from the port usually is added on to the price the buyer eventually pays. At least 19.5 percent of what you pay for the foreign sports car stays on this side of the ocean.

In comparison, to purchase the TR3 in other European countries, you pay the factory base

A Place to Stand

Through the years of recorded history, the men now known as professional engineers have satisfied man's unfolding needs and wants. The role of engineering in providing for these needs is as old as civilization. The remote ancestor of the modern engineer emerged when it was recognized that certain men had special abilities and skills in providing such material fundamentals.

The father of our present-day mechanical engineer is credited with the statement that, "given a place to stand, he could move the world"—recalled in the seal of the American Society of Mechanical Engineers.

Today, in our present engineering field, we have the man with applied knowledge of mechanics, and the graduate engineer whose knowledge is acquired largely through the college textbook. The technician's opportunity for advancement to a professional title, truly credited to him after years of specialization on the job, is almost nonexistent. Therefore, he is forced to remain on his "non-professional" level.

The technician, without his formal degree, has applied his knowledge obtained through years of working experience to the design and development of new products. He has, therefore, contributed to the financial success of his company. However, management has not accepted this man's ingenuitive mind for advancement to a position relinquished by an engineer. Once again a graduate fills the shoes of an individual who deserves recognition.

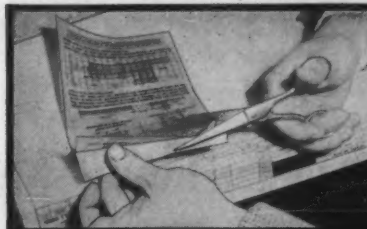
I wonder how many large key manufacturing plants in industry offer management opportunities to graduate engineers only, while recognizing that they would be lost without the knowledge (know-how) of experienced technical men already employed within their own organization.

Truly, "given a place to stand, he could move the world".

Paul A. Taylor

Assistant Editor

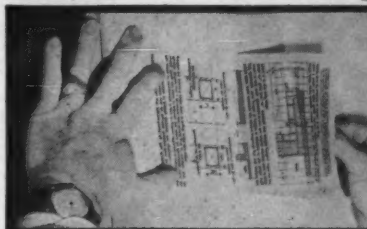
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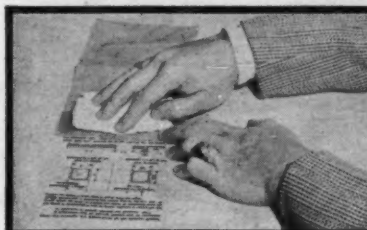
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Buried Tape Recorder Resists Nuclear Blast

Edward W. Schrader, Western Editor

COMPTON, CALIF.—A tape recorder mounted in a hole in the area of a nuclear test blast replaces long coaxial cables previously used to record data. The instrument mounts in a 12-inch dia hole 10 ft deep. It is 7 ft long and weighs 80 lb.

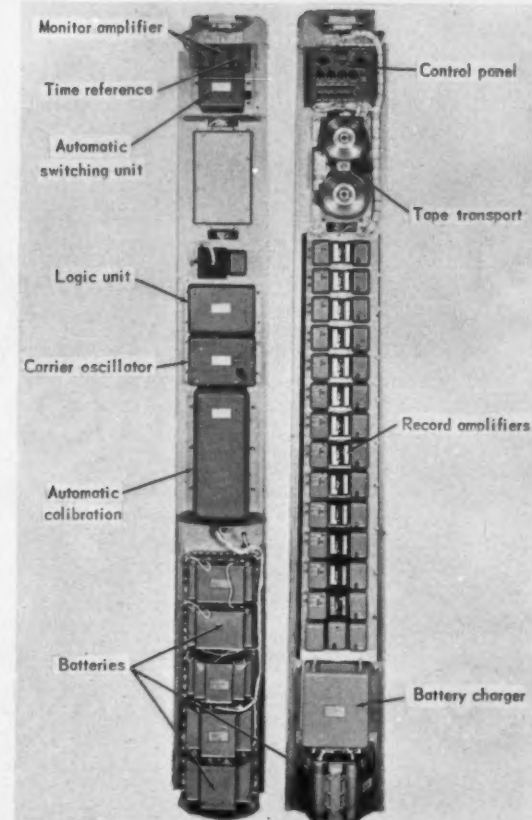
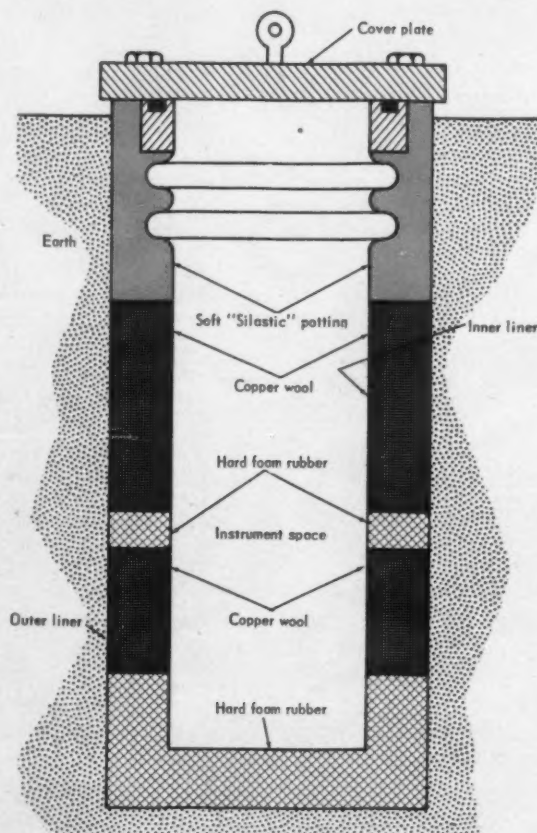
Earlier tests were conducted using long coaxial cables to ground stations located at safe distances from the test blast. The emitted neutrons from the blast induced fields in the cables, giving voltage spikes to the recorded data.

The package contains a tape recorder, a control unit for adjustments prior to lowering in the hole, signal conditioning modules to accept signals from various types of transducers, a battery and a battery recharger.

The control unit and the signal conditioning amplifiers permit adjustment and changes by using plug-in modules to accommodate most a-c and d-c transducers.

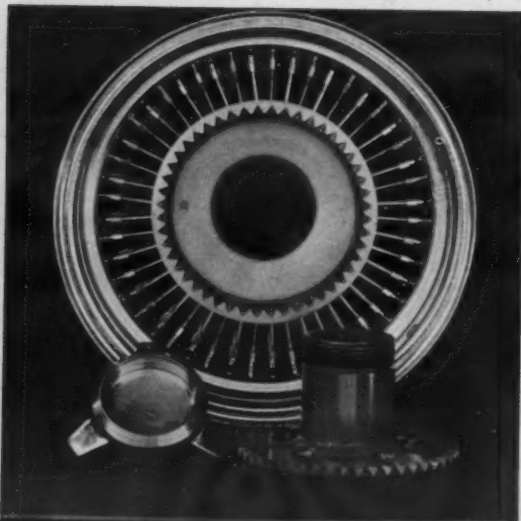
A test plug at the top of the package permits a mobile ground unit to check out the instrument station prior to a test. Batteries for the self-powered unit may be recharged from the mobile check unit with application of 110v 60-cycle power.

The Ground-Mounted Instrument Package is a design development of the Leach Corp.



VERTICAL PLATE supports components including tape recorder. Tape can be played back from ground installation or cartridge can be removed and tape played back at data reduction center.

CYLINDRICAL PACKAGE is protected by double liner and heavy cover plates. Lower end of liner is filled with hard foam rubber. Annular space is alternately copper wool, hard foam rubber and second layer of copper wool. Space is capped with soft silastic potting which seals space and bonds double liners. Vertical rail on inside liner serves as guide track for raising and lowering cylindrical package.



Serrated-Face Hub and Adapter Mount Wire Wheel to Standard Lug

Robert L. Candlish, Detroit Editor

DETROIT, MICH.—A hub adapter with driving teeth on a conical face is fastened onto automobile

HUB ADAPTER and knock-off-type wheel nut are steel castings. Pressed steel adapter is used on high-production models. Serrations seat on angular faces. Tips are relieved to prevent bottoming.

wheel lugs in place of the regular wheel to provide mounting for optional wire wheels. The conical face on the adapter and opposing conical face on the knock-off-type wheel retaining nut position the wheel relative to the axle center line. Matching serrated faces on wheel hub and adapter act as coupling to carry wheel driving and braking loads.

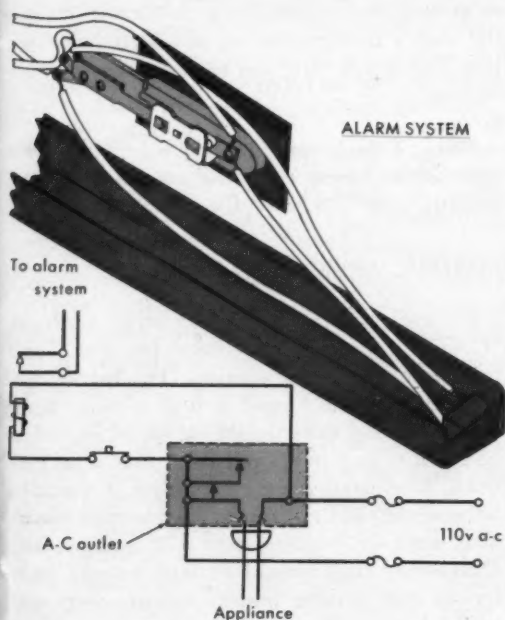
The hub adapter and wire wheel are developments of the Dayton Quick Change Wire Wheel Corp., Design Engineering Div.

Redesigned A-C Outlet Protects Merchandise

Paul R. Taylor, Assistant Editor

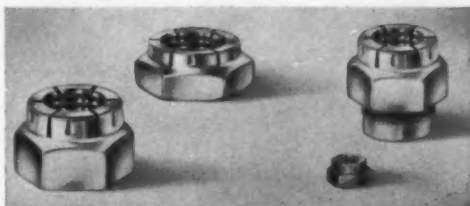
DENVER, COLO.—An a-c outlet, redesigned as an interlock to an alarm system, may be installed in existing merchandise outlets. The number of appliances to be protected is dependent only on the number of outlets. Any one of the appliances may be operated without affecting the alarm. However, if merchandise connector is removed or cut, alarm will fire. Non-electrical merchandise may be protected in the same manner by adding a "loop" network. Details of connecting merchandise outlets to alarm system are described in DESIGN NEWS, October 24, 1960 issue.

Modified a-c outlet is an engineering development of Arthur L. Augustine, Security Electronics Co.



MODIFIED A-C OUTLET is wired in series parallel. A three-wire network provides connection between outlets in a "Raceway" or similar wiring strip. Insertion of appliance plug closes SPST switch, energizing a-c relay to alarm circuit.

Self-locking nut that locks without seating, FLEXLOC



Left to right: full height, thin, microsize, clinch nut.

Three of the most significant features of 1-piece all-metal FLEXLOCs: they are self-locking; they lock without seating; they won't work loose, regardless of vibration.

With FLEXLOC no lockwashers, jam nuts, cotter pins or other auxiliary locking devices are needed. There's nothing extra to put together, come apart or get lost. Your design problem is simplified. Assembly time and costs are reduced. And maintenance expenses are lowered because FLEXLOCs can be readily removed and repeatedly re-used.

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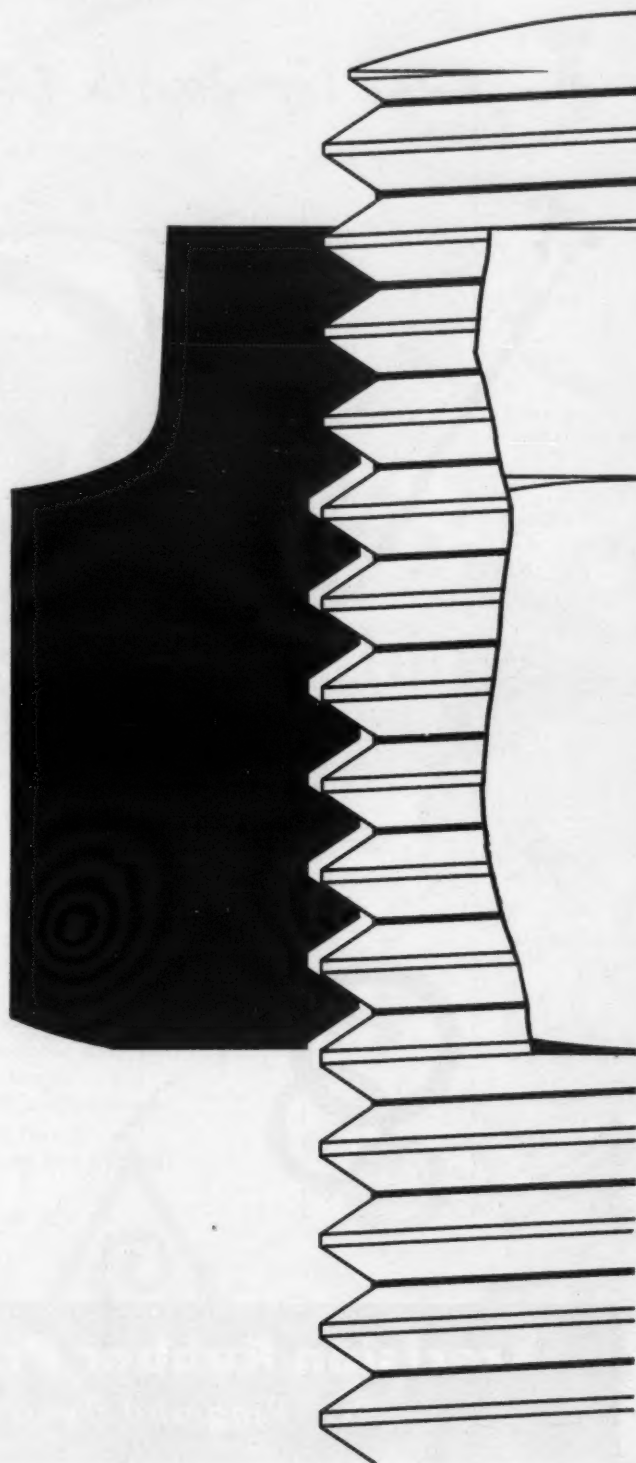
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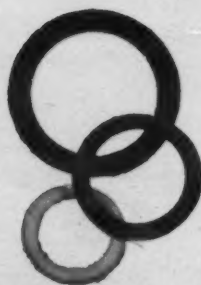
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SEEN AND HEARD

By Lars G. Soderholm, Midwest Editor

Recently, while calling on the director of research of a large company, we happened to talk about engineers in general and how some are aggressive while others are apparently content with routine jobs. After listening to my impatience with plodding engineers, my friend raised his hands and cautioned, "Don't knock the plodding engineer! Without him we'd never get any work done around here. We can only stand so many dynamos; the other fellows have to make sure the day-by-day work gets out.

"Engineers are not all the same. A good engineer is an artist in every sense of the word. Engineering problems have a great number of variables, many at the engineer's control. There are also a great number of solutions—all right answers. The manner in which the engineer solves design problems depends a great deal on personality. Engineering creativeness varies with the individual and this should be taken into consideration when jobs are being assigned.

"The so-called 'plodding' engineer may not be as creative as others but he is durable. He has the ability of sweating out and seeing through jobs that would 'bug' his more aggressive counterpart.

"What I think really bothers you is that both types of engineers carry the same title while, actually, their jobs are quite different."

MATERIAL APPLICATION STORY . . .

My secretary walked into my office and said, "I have a good design story for you," and handed me one of her earrings. The earring had a ceramic magnet hinged to it so it could swing around behind the ear lobe. Magnets seemed to be about 1/2-inch in dia and about 3/16 of an inch thick. The earrings were very good, I was told, because they did not pinch. This sounds reasonable, since the holding force is distributed over a relatively large area. I chalked up one point for an enterprising jewelry manufacturer and we both got back to work.

LIFETIME GASKETS . . .

The Victor Gasket & Mfg. Co.'s engineers are a



bit "shook up" over a press release (not theirs) that gives the general impression that they have perfected a lifetime gasket. The release relates to a small gasoline engine. The Victor people say that the gasket will not last forever. If you take the head off the engine a number of times, you can't expect the same gasket to continue to seal. I wish some other manufacturers were as diligent in correcting misconceptions of their products that could start a designer down the road of wishful thinking.

ECONOMIC AGONIES . . .

The economic situation in the Midwest, or perhaps I should qualify my personal observations as being more true of Chicago, is rather strange. Things are slow here as all over, especially in steel and automotive industries. While the attitude of business represents caution, there are signs of underlying optimism. For one thing, organizational staffs are being reorganized quietly. Good, competent executive personnel are being bought for more money to strengthen organizations. The cutting seems to be over—now is the waiting period before the big onslaught on the reluctant buyer's dollar.

RELIABILITY

The word, if you haven't heard, is "reliability"—and it's about time. Reliability comes from missile work in which proper functioning of the entire unit depends on proper functioning of each component part. Great pains and much money are expended to make sure everything operates at the correct time in the correct manner—all in the name of reliability.

I have hinted at times that many of our consumer products on the market are plain junk. The price squeeze prevents quality.

The use of a word may be a trick but I hope the trend isn't. Basically, reliability, if honestly presented, is exactly what we need in many of our appliances and automobiles. Any increase in reliability is usually well worth the added cost.



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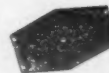
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Integral Lighting of Flight Vehicle Instrument Panels

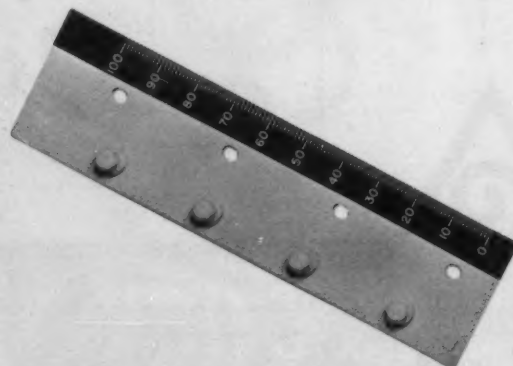
E. J. Stefanides, Central States Editor

The design of integral lighting systems for flight vehicle instruments and panels is quite critical and must meet exacting military specifications.

The lighting of nomenclature on the panel proper is accomplished by edge lighting from light sources inserted in the laminated plastic panel. Light is colored by filters, then travels through the interior of the panel, escaping by refraction through nomenclature engraved in the opaque panel face. A white translucent underlayer between the opaque surface layer and the transparent core provides white markings for daylight reading.

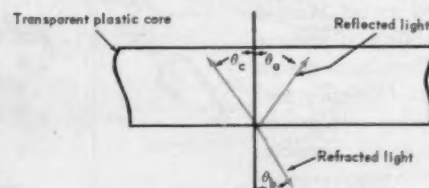
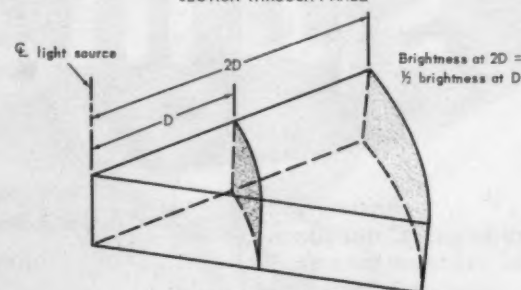
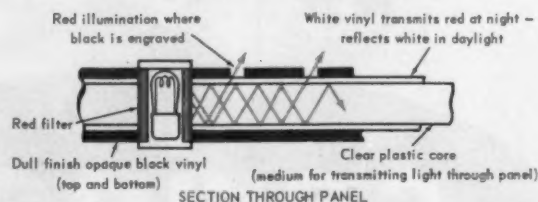
Edge-lighted panels, until recently, were governed by MIL-P-7788 which still is adhered to on some designs. A later specification, MIL-P-7788A, has been released and is coming into greater prominence. These specifications set up basic panel requirements as follows:

	MIL-P-7788	MIL-P-7788A
PANEL THICKNESS	0.170 to 0.220	0.170 to 0.220
ILLUMINATING COLOR	Red (identification)	Aviation red (NBS 3215)
BRIGHTNESS (filter removed)	0.5 - 7.5 ft lamberts (7/1 ratio)	1.0 - 5.0 ft lamberts
APPLIED VOLTAGE	28 v	28 v



SELF-CONTAINED PANEL contains four light sources, is subassembly of larger panel.

THEORETICAL CONSIDERATIONS



- OPTICAL PROPERTIES OF ACRYLIC PLASTIC CORE MATERIAL
- (a) Transmission = 92 percent (relative to air)
 - (b) Index of refraction = 1.49
 - (c) θ_c = critical angle, minimum angle at which ray may approach normal to surface and still be reflected.
 $\theta_c = 42.2$ degrees
 - (d) If $\theta_c > 42.2$ degrees then $\theta_a = \theta_c$
 - (e) θ_b = angle refraction
If $\theta_c < 42.2$ degrees then $\theta_b = \sin \theta_c \div 1.49$

EDGE-LIGHTED PANEL is laminated plastic with core of acrylic plastic such as Plexiglas or Lucite. Core serves as conducting medium through which light is piped for refraction through nomenclature engraved in opaque outer vinyl layer. Although refraction and reflection calculations are approximations because vinyl-plastic interfaces are not truly flat planes, irregularities tend to average out. Light intensity does not follow inverse square attenuation rule of free radiation since light is conducted in reflective channels. Brightness is linear function, is inversely proportional to distance from source.

Both of these specifications call for red illumination which is achieved through individual lamp filters. Filtering can be achieved by painting, staining or with mechanical filters. Painting or staining, though attractive from the standpoint of space conservation, presents serious difficulties in control of color and transmission because of difficulties involved in controlling finish thickness.

Mechanical filters are fabricated from pre-dyed transparent plastic and can be controlled quite easily by machining or adding to the thickness. Since the filter itself transmits only a small portion of the light, its effect must be calculated in the design. Identification red transmits only 8 percent of the available light while aviation red has a transmission of 21 percent.

These specifications include upper and lower limits on nomenclature brightness. Keeping the brightness within these limits avoids the psychological dangers of too great a contrast.

Panel types include both conventional and self-contained types. The self-contained types employ either printed or embedded wiring so that no portion of the lamp assembly protrudes behind the panel. In another type of panel, white and black coats of paint sometimes are substituted for the outside plastic layers.

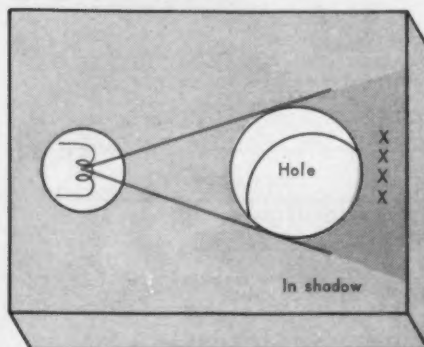
Integrally lighted instruments present a more complicated array of problems. Specifications are more critical, less space is available for components and serious consideration also must be given to elimination of stray lighting. The basic requirements of the two specifications which govern instrument lighting are:

(Text continued on page 11)

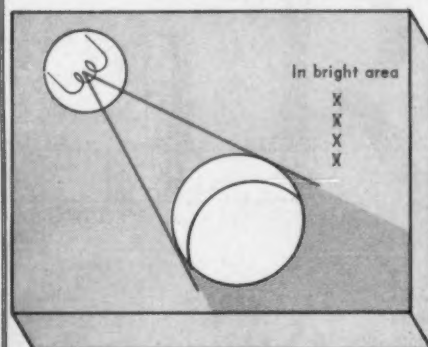
	MIL-L-25467A	MIL-L-27160
APPLIED VOLTAGE	5.0 v	5.0 v (basically)
COLOR	Aviation red (NBS 3215)	White (2900 K)
CHARACTER BRIGHTNESS	0.5 - 1.5 ft lamberts	At least 80 pct - 0.05 to 0.15 ft lambert at 2.7 v At least 90 pct - 0.04 to 0.18 ft lambert at 2.7 v Pointers 0.07 to 0.21 ft lambert at 2.7 ft

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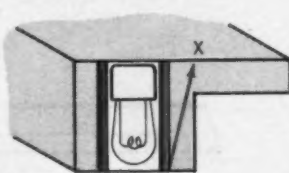
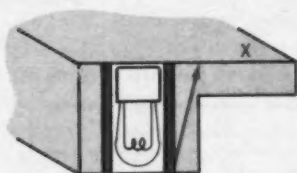
POOR DESIGN



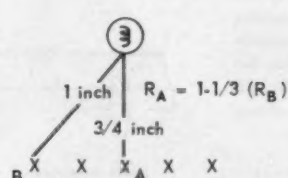
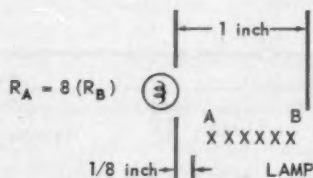
GOOD DESIGN



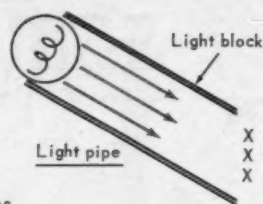
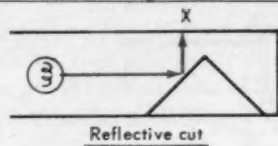
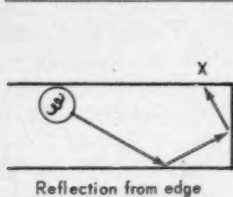
HOLE PLACEMENT



THIN SECTIONS



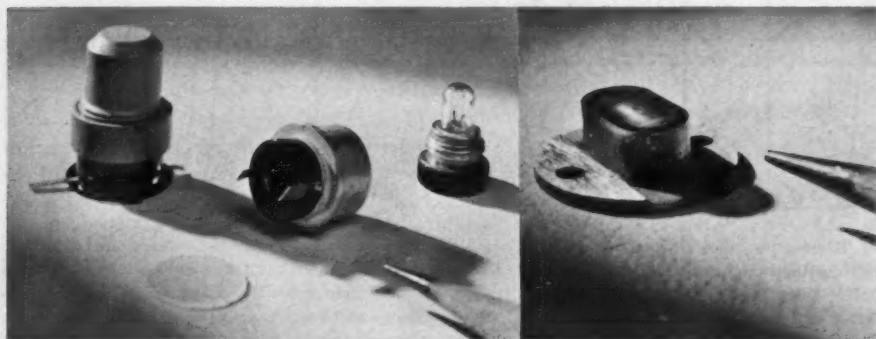
LAMP PLACEMENT



LIGHTING AIDS FOR DIFFICULT JOBS

DESIGN PRACTICE—holes, cutouts and counter-bores should be kept to minimum and placed so that nomenclature is not in shadow of hole. Where thin sections are necessary, light source should be placed as close as possible to nomenclature and nomenclature as close as possible to

thicker section. Brightness of individual letters varies inversely as distance from source. Extremes in location of individual letter relative to source should be avoided. Lighting aids shown in bottom sketch are used in difficult applications, increase panel costs.



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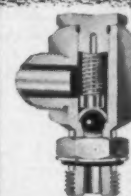
PIPE FITTINGS



ADAPTER UNIONS

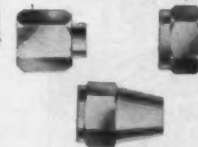


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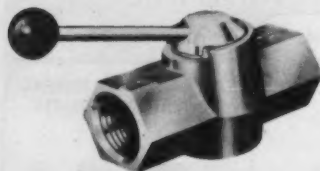
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CIRCLE SEAL PLUG VALVE ...LEAKPROOF IN HIGH VACUUM SERVICE



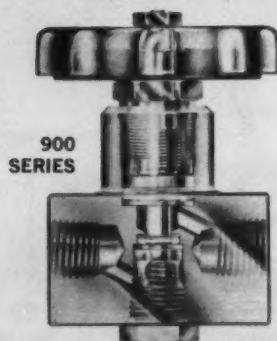
9200 SERIES

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Design of the Circle Seal 9200 Series Plug Valve features use of three O-rings. In closed position, O-ring on cylindrical face of plug prevents leakage past inlet port. In open position, the valve is fully ported and allows straight-thru flow passage. Stem leakage is entirely eliminated by static O-rings at top and bottom around circumference of plug. Effortless quarter turn from full open to full close. No springs used...no adjustments required.

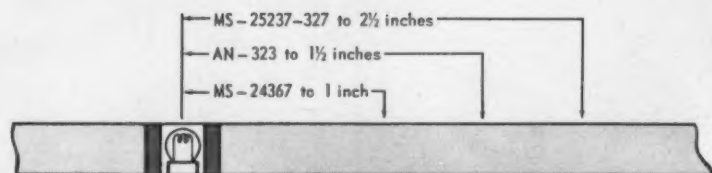


Unique design combines positive leakproof shutoff with full flow passages and freedom from wire drawing. Design of stem and seat permits simplified throttling of flow. Light fingertip operation actuates either a hand-wheel or toggle lever for rapid actuation. Unique and useful variations on the basic 900 Series configuration:

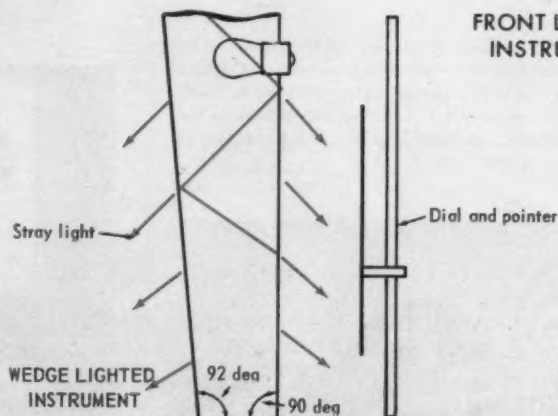
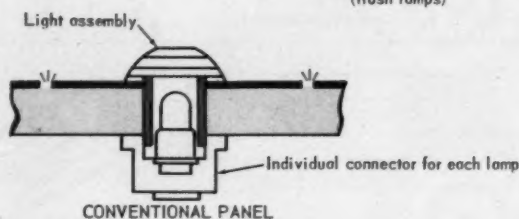
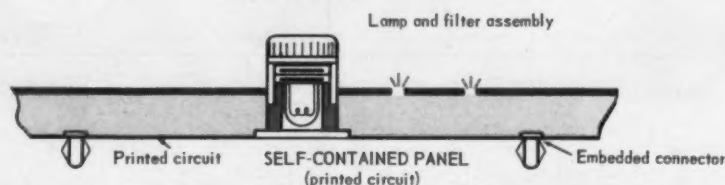
- Right angle flow.
- Integral Relief—combines relief valve function with shutoff permitting cylinder thermal pressure relief, etc.
- Triport with one inlet and two outlets or one outlet and two inlets.

Instrument Panels . . . Cont.

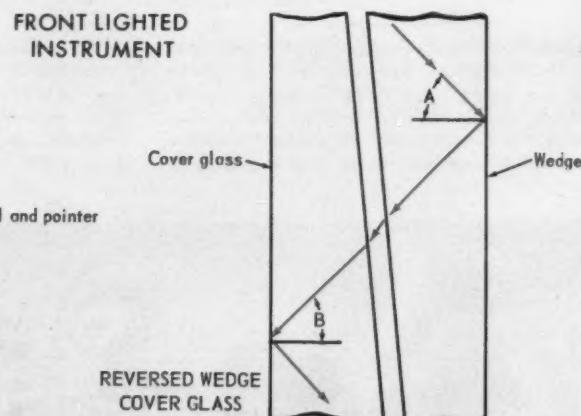
TYPICAL PANELS AND LAMP TYPES—upper view shows capabilities of several basic lamps. Maximum effective distances shown are with red filters. Lower views show conventional and self-contained panels. Conventional type requires separate connectors for each lamp. Self-contained panels are manufactured with both printed and embedded circuitry. Embedded circuitry has greater reliability, is essential on large panel with large number of lamps and large power requirements. Flush lamp assemblies are currently used for 5v panels. Embedded lamp is possible because of extreme durability of MS24367 lamp which is in excess of 60,000 hours.



EFFECTIVENESS OF SEVERAL BASIC LAMPS
(modified to 28 v)

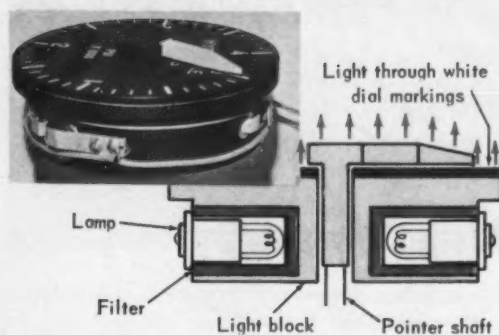


WEDGE-LIGHTING is used for instruments with low torque output requiring lightweight pointers. Sides of transparent wedge are at 2-deg angle to each other. Light from source is reflected alternately from sides. Complementary angles gradually diminish until ray strikes sur-



face at less than critical angle and refracts out of wedge. Light is refracted from both front and back of wedge. To eliminate stray light refracting from front of wedge, reverse wedge cover glass can be used to reduce stray light refraction approximately 50 percent.

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BACK-LIGHTED INSTRUMENT INDICATOR

Although the white lighting specified by MIL-L-27160 does not have the psychological advantages of the red, it does have certain design advantages. It filters out less of the available light, giving it a transmission in excess of the 20 percent for the red. Thus, it requires fewer lamps which generate less heat and require less space. These design advantages may often outweigh the psychological disadvantages.

Edge-lighting, back-lighting, wedge-lighting and flood-lighting are used in instrument lighting. Edge-lighting of instruments applies the same principles as in panel lighting. Flood-lighting normally is used for small presentation because of difficulties in controlling stray light.

In back-lighting, the lamps are placed in a light block behind the presentation and both the black and white dial and the pointer are lighted by transmission of this light. In back-lighting, dial finish is applied to allow a small amount of light to leak through, (0.02-0.1 ft lamberts). This eliminates the floating effect which would result if only the dial and numerals were lighted.

Primary advantage of wedge-lighting is that many pointers, no matter how delicate, can be lighted. In wedge-lighting, the thickest part of the wedge is located at the top so that light refracted from the front is directed downward, as the specifications tolerate more stray light in this direction. Stray light can be reduced further (as much as 50 percent) by use of a reversed wedge cover glass. Background lighting is no problem with the wedge system.

The newest development in integral lighting is the electroluminescent lamp or panel. Uniform lighting can be achieved quite easily without the complications involved in the use of a point light source. At present, the main disadvantages of this method is short panel life resulting from phosphor decay. When this is overcome, electroluminescent lighting will provide a far more advantageous form of lighting than is presently available.

Design information presented in this article was provided by the Engineering Department of Oppenheimer Plastics, Inc., Willow Grove, Pa.

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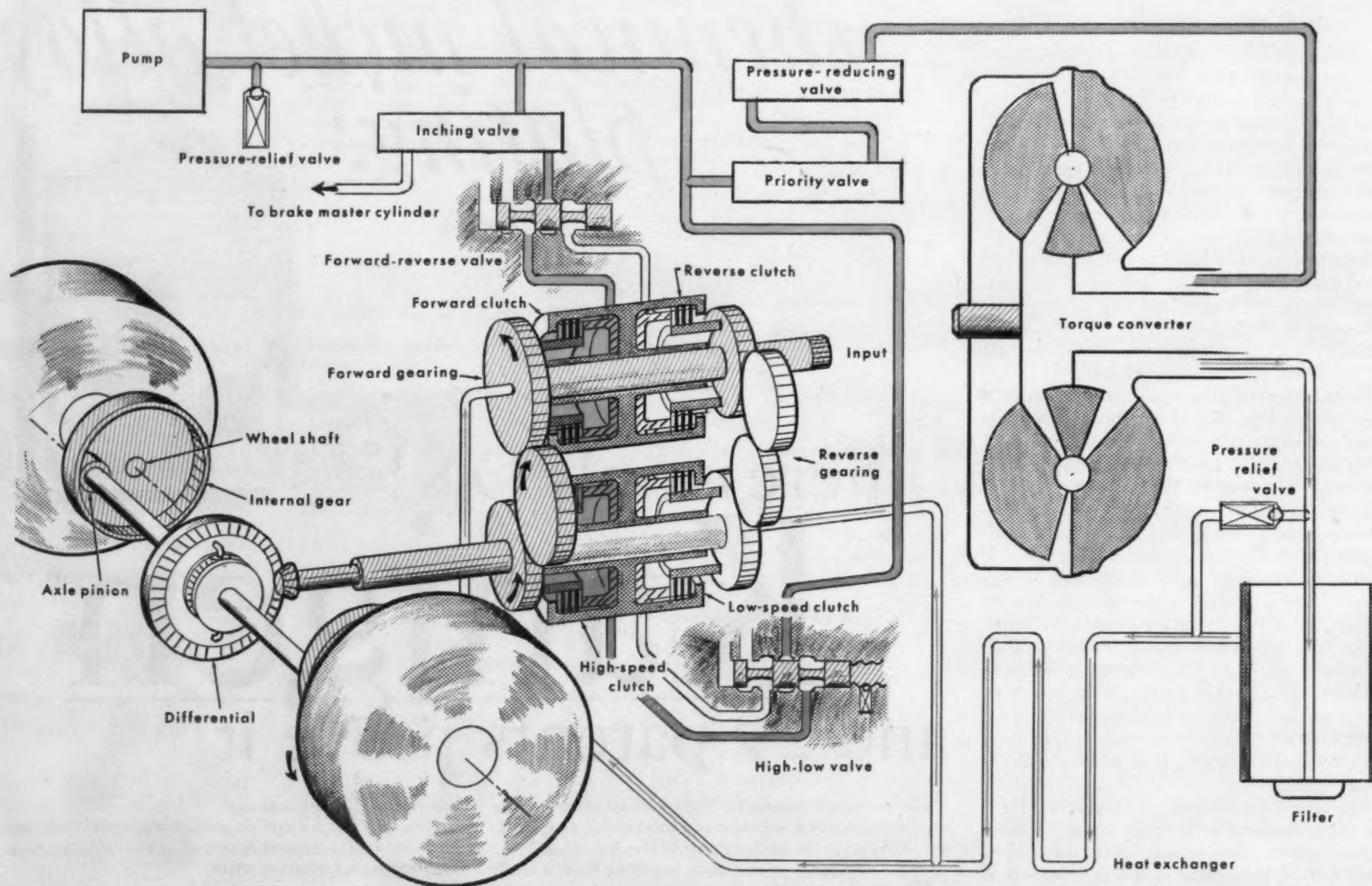
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Two-Speed Transmission with Integral Axle Provides Design Versatility

Lars G. Soderholm, Midwest Editor

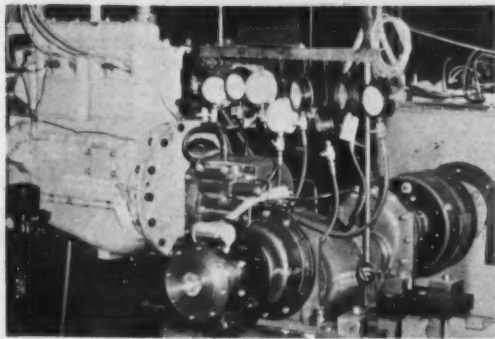


TWO-SPEED TRANSMISSION uses two clutches on input shaft to select full torque forward or reverse directions of travel. Two additional clutches located on output shaft select low or high speed ranges. All clutches are heavy-duty and pressure-lubricated. Drive axles distribute power from differential to wheel shafts. Drive axle pinion meshes with internal gear on wheel shaft. Offset permits wheel shaft to be located anywhere on 2½-inch radius around drive axle pin-

ion. This allows wheels to be located high or forward. Hydraulic pump operates at engine speed, supplies 7.5 gpm at 110 psi maximum. Priority valve sends oil to clutches first while excess oil is used to charge torque converter. Control circuit of system has two branches. Inching valve is connected in series before forward-reverse directional valve. This allows brake cylinder pressure to unload valve spool spring and reduce pressure in clutch. Reducing or shutting off pressure in

clutch permits creeping of vehicle. After priority valve, pressure-reducing valve cuts pump pressure to 55 psi maximum for use in torque converter. When leaving converter turbine, oil is filtered and passed through heat exchanger in lower portion of vehicle radiator. From heat exchanger, oil is pumped through center of each transmission shaft and distributed to clutch packs and gear bearings.

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A full-torque shifting, full-reversing transmission designed for use on materials handling equipment is part of a complete assembly featuring an integral differential and axle. The two-circuit hydraulic system features a priority valve to insure proper clutch actuation under all conditions and a brake pressure-operated inching valve for precise positioning. The ring gear and pinion power coupling from differential to axle permit the wheel shaft to be located high or low, forward or backward in relation to the drive axle.

The basic design thinking in planning this transmission axle assembly was to provide a good balanced power train that could be used in a great number of vehicles for materials-handling applications. By using the manufacturer's own engine, all the major components will be made by the company which permits a matching of parts to secure the greatest operating efficiencies.

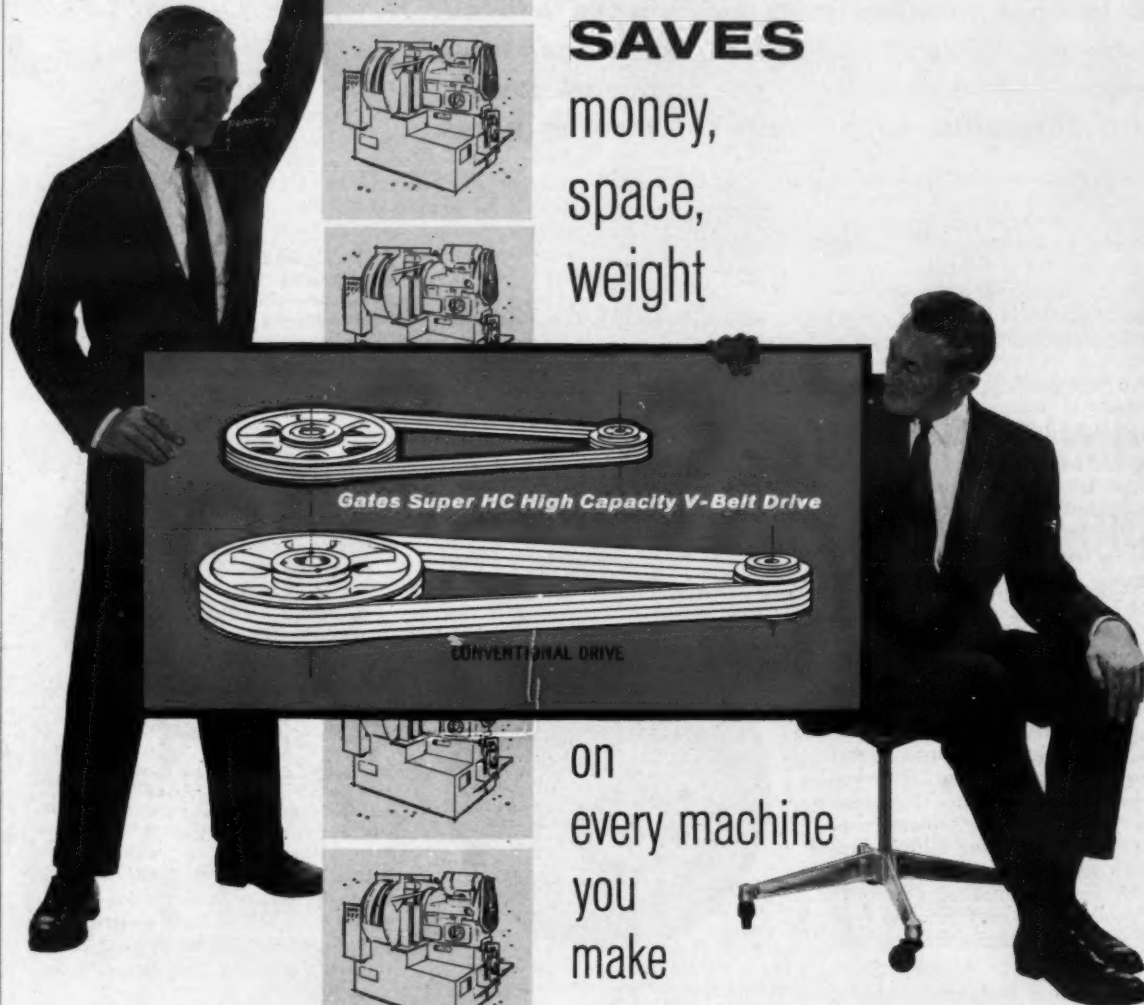
Power from the engine (up to 300 lb-ft torque) is fed into the transmission through an 11-inch torque converter built into a SAE No. 4 bell housing. Stall-torque ratio of converter is 2:1. Two-speed transmission selects forward or reverse and high or low ranges by hydraulically actuated multiple-disc clutches.

A 7.5-gpm pump driven at engine speed provides oil to both control circuit and converter-and-lubrication circuit. Priority valve assures oil supply for clutches at low engine speeds. Inching valve in control circuit operates off brake pressure to reduce or diminish entirely pressure in clutches. Converter circuit oil provides lubrication to clutch packs and gear bearings after passing through heat exchanger.

Compact transmission housing measures 19 inches in overall length and 17½ inches in width. Weight is 425 lb. Against transmission housing is a heavy-duty differential of the type used on farm tractors. Two axle widths are available and, because of ring and pinion lawn mower-type drive, any number of wheel shaft positions is possible in a set radius about the drive axle in bell housing.

The new transmission axle assembly is being used in a towing tractor and in a new line of lift trucks. This two-speed transmission and axle assembly is being manufactured by the Minneapolis-Moline Co., Hopkins, Minn.

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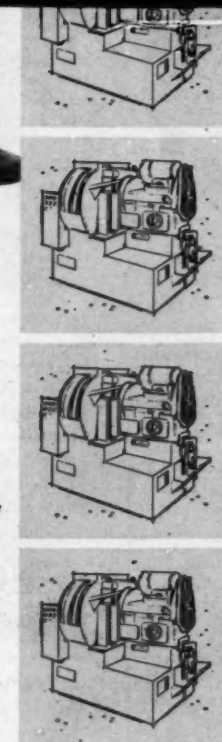
The Gates Rubber Company, Denver 17, Colorado

Gates Super HC V-Belt Drives

BP-9



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VALUE ANALYSIS FACT SHEET

Formbrite Drawn Brass Parts

How to open finishing room bottlenecks and cut polishing costs up to 50%—produce stronger, more scratch-resistant parts—and get additional savings—with Formbrite, superfine-grain drawing brass.

Very often in the production of drawn brass parts which are to be plated or lacquered, finishing costs are greater than those of all preceding operations—or even the cost of the metal. Under any circumstances, they are a high percentage of total costs.

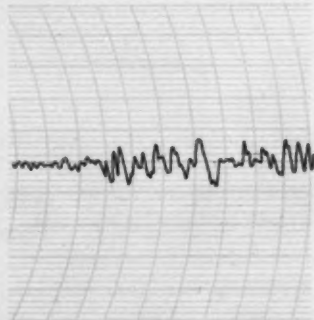
Furthermore, parts go through the pressroom a lot faster than they can through the finishing room, creating bottlenecks in production.

ENLARGED SURFACE TRACES at the right prove that you can lick both cost and time problems with Formbrite®. Anaconda superfine-grain drawing brass. Savings in polishing costs reported by users run from 40 to 50%. These are net savings, as Formbrite costs no more than ordinary drawing brass.

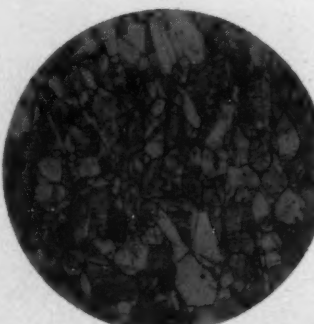
STRONGER, MORE SCRATCH RESISTANT.

Formbrite is stronger, harder, springier than the usual drawing brasses in the same standard tempers, yet retains remarkable ductility for forming and drawing, and takes sharp, clean-cut ornamental die impressions. The harder surface means fewer rejects from scratching and marring during handling. In some instances, the superior strength and hardness of Formbrite make possible the use of a thinner gage metal, with an additional saving in material cost.

SIZES AND TEMPERS. Brass manufactured by the Formbrite method, with its special characteristic of superfine-grain structure, is supplied in standard Formbrite temper, half-hard, three-quarter-hard, hard, and extra-hard

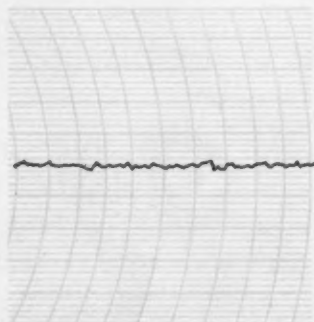


Enlarged surface trace of standard drawing brass (grain size, .045 mm) after 40% elongation. This kind of roughness causes "orange peel" effect in the working of standard drawing brass. Smoothing such mountains down to the valleys takes considerable cutting.



This is the microstructure, shown 75x, of the standard drawing brass used above.

tempers, and can be rolled in heavy coils to .004" in thickness by 24" wide, weighing 100 pounds per inch of width. The table below gives physical data and terminology for Formbrite tempers.



Enlarged surface trace of Formbrite drawing brass (grain size, .005 mm) after 40% elongation. Surface smoothness after deformation is the test of a drawing brass's polishing characteristics. It is relatively easy to level these little hills on the surface of Formbrite. In many cases, users find they eliminate cutting operations altogether, need only a simple color buff.



This uniform superfine-grain structure of Formbrite, shown 75x, is produced by special procedures for rolling or drawing and annealing developed by Anaconda American Brass Company.

ALLOYS. In addition to 70-30 brass, the following Anaconda alloys also are produced by the Formbrite method: Yellow Brass-59, Gilding Brass-4, Commercial Bronze-14, Red Brass-24, and Low Brass-32.

TECHNICAL ASSISTANCE. For help in selecting the alloy and temper to handle your particular job—for a copy of Publication B-39 with more details about Formbrite—see your Anaconda representative. Or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

TERMINOLOGY FOR FORMBRITE TEMPERS

TENSILE STRENGTH		ROCKWELL B		DESIGNATION TO BE USED
LB.	SQ. IN.	HARDNESS		
MIN.	MAX.	MIN.	MAX.	
49,000	59,000	40	65	Yellow Brass—Formbrite
57,000	67,000	60	77	Half-hard Yellow Brass—Formbrite
64,000	74,000	72	82	Three-quarter-hard Yellow Brass—Formbrite
71,000	81,000	79	86	Hard Yellow Brass—Formbrite
83,000	92,000	85	91	Extra-hard Yellow Brass—Formbrite

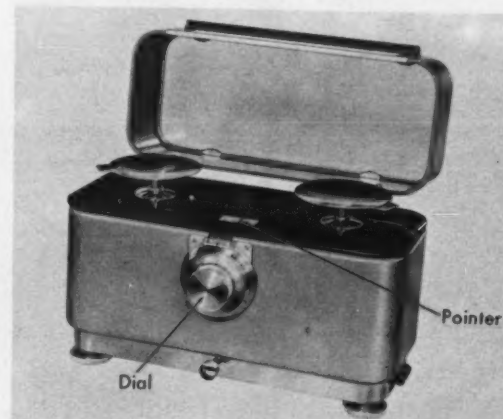
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IDEAS...

MECHANICAL DEVICES

Hairspring Mechanism

Victor W. Wigotsky, Eastern Editor



BALANCE HAS 120-GRAM CAPACITY and is sensitive to 2 milligrams. Torsion bands of corrosion-resistant alloy keep torsional properties constant over wide temperature range.

Compactness and increased weighing speed were the essential objectives in the redesign of a precision balance. These were achieved by replacing a movable rider weight with a hairspring-dial mechanism.

The previous design had several disadvantages which are overcome by the new arrangement. First, a rider fork was used. When adjusting the rider weight over its full scale range the space required by the rod extension doubled the frontal area needed for using the scale. Second, it was necessary to lock the balance, to prevent damage while the rider weight was being positioned and to release it to determine if the last adjustment produced equilibrium.

The hairspring mechanism eliminates all the "secondary" manipulation and the necessity for any extension beyond the balance case. Desired linearity throughout the range is achieved by properly specifying the torque required by the phosphor bronze hairspring, and providing for small adjustment in the mechanical linkage. Weighing is faster, since turning the dial infinitely controls torque produced. There is no need to lock and release the balance structure. Potentially damaging loads on the weighing system are prevented by the steady turning of the dial knob.

The new dial-reading balance was designed by The Torsion Balance Co., Clifton, N. J.

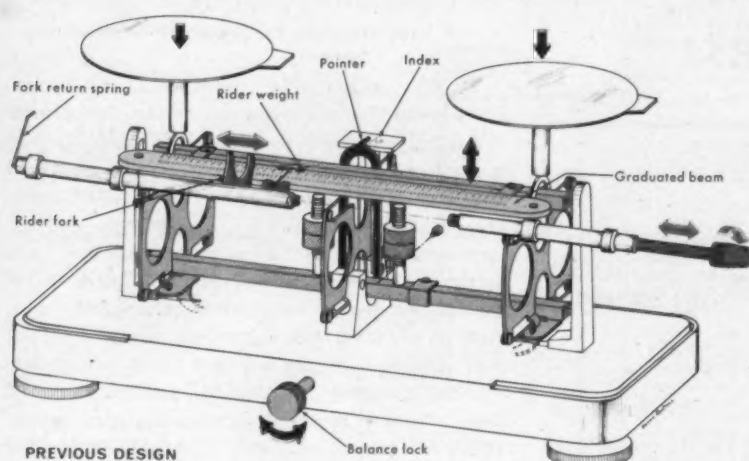
FORMBRITE

Superfine-grain drawing brass
a product of

ANACONDA®

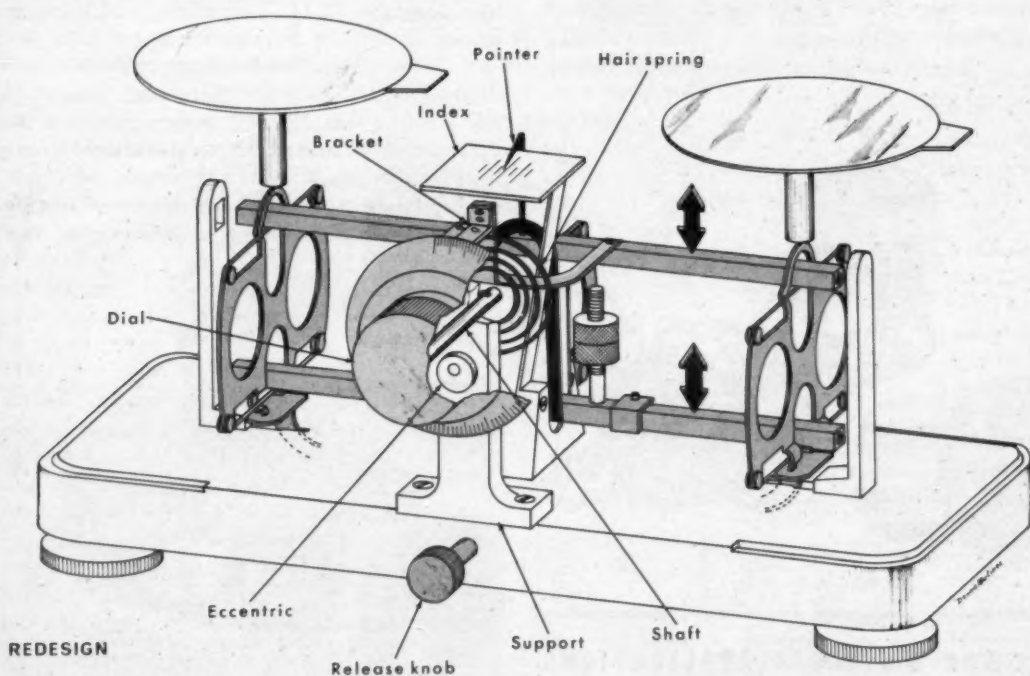
Anaconda American Brass Company

Replaces Movable Rider Weight on Sensitive Balance



PREVIOUS DESIGN

IN PREVIOUS DESIGN, graduated beam and rider weight are used to set torque. Rider fork manipulates rider weight from outside balance case. Balance mechanism is locked when fork is manipulated, since undue deflections can damage weighing system. Rider rod extends appreciably beyond right side of case, requiring approximately twice as much table space as basic instrument. Also, balance is subject to accidental damage if rider rod is left in extended position. Rider causes wear at its point of contact with supports, thus effecting weighing accuracy.



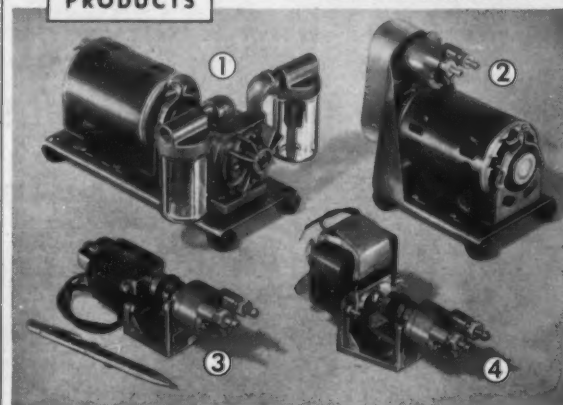
REDESIGN

WHEN USING DIAL AND HAIRSPRING MECHANISM to determine unknown weight, balance is released by operating release knob, and dial is rotated slowly until pointer coincides with equilibrium position of index. Weight of unknown is then simply read by comparing graduations on dial against fixed pointer of balance case. There is no need to lock and release balance structure, since operator, when turning the dial knob, can infinitely control loads on weighing systems. Balance requires only bench space equal to case. Weighing time is reduced by precise approach to exact weight without

overshooting or necessity to bracket unknown weight. Zero marking of dial is adjusted to agree with index by rotation of eccentric which contacts a pin in dial. Outer end of hair-spring is clamped to bracket which is fastened firmly to upper beam of balance structure. Inner end of spiral spring includes collar attached to shaft to which dial is clamped. Dial and spring system has only one point of mechanical friction, the shaft within the support. Wear, if any, at this point will not produce inaccuracy.

ROTARY AIR
GAST
PRODUCTS

THINKING small?
LOOK AGAIN!



TWO TYPES OF MINIATURE OIL-LESS **GAST** ROTARY **VACUUM PUMPS** and **AIR COMPRESSORS**

① Model 1030-V110-206 Vac. Pump, 1/20 h.p. Up to 1 c.f.m.; to 15" vac.

② Model 0330-V112-206 split phase 1/20 h.p. motor, .48 c.f.m. Up to 20" vac. or 15 p.s.i.g.

③ Model 0330-V102A-151 series wound motor. Up to .57 c.f.m. To 20" vac. or 10 p.s.i.g.

④ Model 0330-V110-202 shaded pole motor. Up to .35 c.f.m. To 20" vac. or 10 p.s.i.g.

⑤ (Below) Model 0630-P103 Compressor, up to .6 c.f.m. To 25 p.s.i.g. or 24" vac.

FOR ORIGINAL EQUIPMENT APPLICATIONS ON CONTROLS, INSTRUMENTS, BUSINESS MACHINES, LAB EQUIPMENT

Now — where space is very limited — you can provide moderate vacuum or pressure with one of these two types (3 series) of Gast semi-miniature Air Pumps.

They run entirely without oil. Carbon vanes lubricate themselves, producing a completely oil-free air blast or exhaust. Rotary design is simple, trouble-free and positive in air displacement.

The largest Model 1030 (1 above) delivers up to 1 c.f.m. running open at 3450 r.p.m. Model 0630 (5 below) has identical exterior, delivers up to .6 c.f.m. Smaller type 0330 (2, 3, 4 above) is shown with a choice of motors to suit various pump applications, both a.c. and d.c. With a rotor diameter smaller than a penny, Model 0330 produces up to .67 c.f.m. (open) at 6000 r.p.m.!

These "semi-miniatures" may solve a problem for you — investigate today!

WRITE TODAY FOR BULLETIN M-OVP.

GAST MANUFACTURING CORP., P.O. Box 117-G
Benton Harbor, Michigan

See Catalog
in Sweet's
Design File

GAST
ROTARY

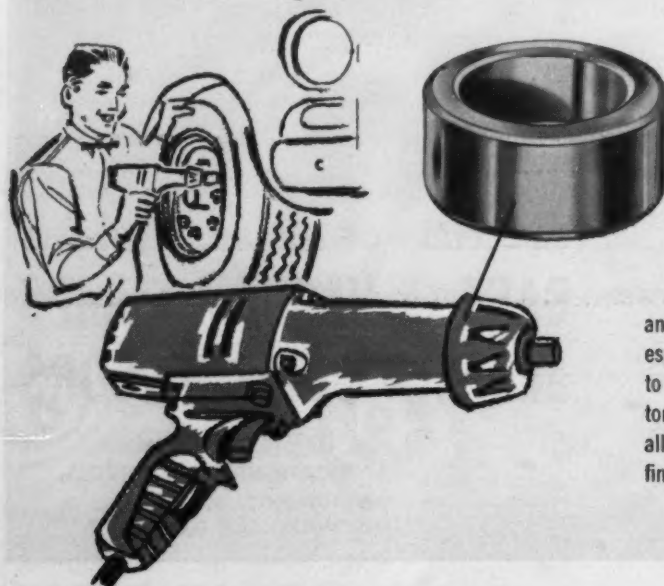
• AIR MOTORS TO 7 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.

"Air may be your answer!"

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600 SERIES

THE FORGEABLE BEARING ALLOYS THAT
STAND UP ON THE REALLY TOUGH JOBS!

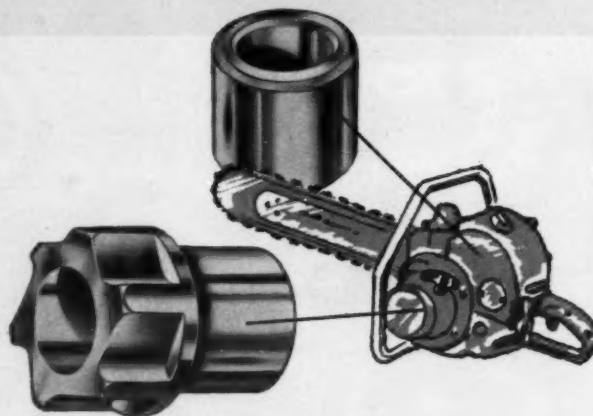


600 ALLOY NOSE BEARING WITHSTANDS THE PUNISHING SHOCK LOADS OF AN IMPACT WRENCH

This heavy-duty impact wrench takes the rigorous punishment of hard industrial use right on the nose . . . and right on the 600 Series nose bearing. This bearing was especially chosen by the manufacturer because of its ability to absorb a range of 1600 to 1800 impacts per minute at a torque of from 0 to 250 foot pounds. By specifying 600 bearing alloy, the manufacturer gets superior performance from his finished product.

600 ALLOY RATCHET AND DRIVE GEAR BEARING TAKES THE TERRIFIC POUNDING OF A HIGH POWERED CHAIN SAW

Professional woodcutters give chain saws a rough time for hours on end, all year round, and these rugged saws must be built to take punishment. With chain speeds up to 3000 feet per minute, the ratchet and drive gear bearings, for example, must have a very high strength, hardness and good resistance to wear with minimum lubrication. That's why 600 Series Alloy was specified for both parts . . . the ratchet is a forging and the bearing was produced from 600 Series rod.



MUELLER BRASS CO. SPECIALIZES IN ALLOYS FOR DIFFICULT APPLICATIONS

For complete engineering data, write
today for Special Alloys Kit No. 13.



The alloys available from the Mueller Brass Co. range from those having high hardness and wear properties, to alloys that must possess excellent electrical conductivity, and ones that must have free-machining properties. Let our engineers help you select the alloy best suited to your exact application.



MUELLER BRASS CO. PORT HURON 23, MICHIGAN

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IDEAS . . .

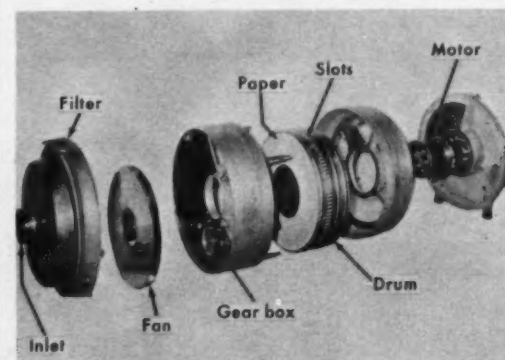
MECHANICAL DEVICES

Simple Ratchet Gives High

Volrath Holmboe, Correspondent in Sweden

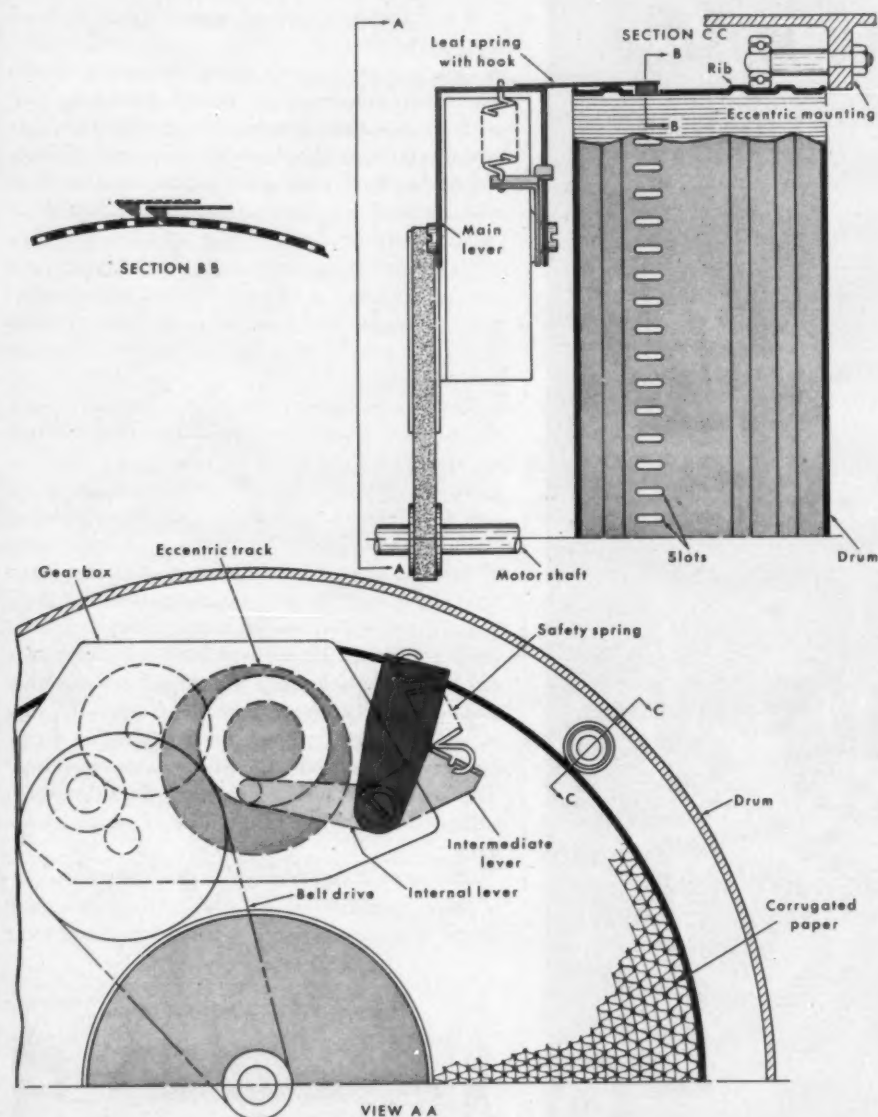
A simple spring ratchet operates on the slotted sheet-metal rim of a drum to provide intermittent low-speed rotation. Reciprocating hook motion is governed by a gear with an eccentric track and connecting links. Speed reduction of 100:1 is obtained easily without resorting to large and expensive gears. Hook and slots, gear box and belt-pulley cut speed from 1800 rpm of motor to about 0.1 rpm of disc, corresponding to a speed reduction of 18,000:1. 100:1 is taken care of by hook and slots, 60:1 by gear box and 3:1 by belt-pulley.

The arrangement is part of an air dryer which uses a slowly rotating corrugated-paper honeycomb disc instead of purely chemical agents. Wet air is driven through the lower part of the disc, where moisture is absorbed by the impregnated hygroscopic walls. Moisture is removed again by heated air passing through the upper part. Use of the honeycomb disc has greatly reduced overall dimensions and provides continuous processing. For a capacity of 75 cubic meters per hour the diameter of the dryer is 38 cm and overall length is 43 cm. Weight is about 20.5 kg and total power consumption is 535w. The air dryer was developed by Carl Munters & Co., Stocksund, Sweden.



LOW DISC SPEED minimizes heat transfer from hot sector. By increasing speed, apparatus could also serve as combined dryer and heat exchanger. Cooling air, after being heated by motor, is used for hot sector. Electric heater provides additional heat. Because of increase in moisture conversion efficiency with increasing temperature, hot air segment need cover only about one-third of disc area.

RPM Reduction, Saves Gear Cost in Air Dryer



ECCENTRIC TRACK in last gear of gear box guides linkage forming reciprocating motion of hook. Linkage comprises three levers tilting about common shaft. First two levers (internal and intermediate) are rigidly attached to shaft to insure positive transmission of tilting motion. Third lever carries leaf spring and hook, and is hinged on shaft. Its motion is governed by helical spring connecting it with intermediate lever. Spring protects hook and slots from damage in case drum should seize. Leaf spring on main lever presses hook gently along drum periphery and into slots. Wedge shape insures one-way rotation. Metal sheet drum with circumferential

ribs provides rigid frame for corrugated paper honeycomb disc. Sheet metal also facilitates production of slots which are punched easily. Drum rolls against four external ball bearings, eccentrically mounted, spaced 90 deg apart around circumference. Arrangement leaves center free for electric motor and avoids stressing paper fill during rotation. Hygroscopic properties of disc are raised by using asbestos paper impregnated with lithium chloride. Additional stiffness is obtained by painting front and rear of disc with phenol resin, eliminating need for spokes.

If
all you have
for a relay
is a sudden
impulse...



An impulse relay—one that when pulsed will turn something on and leave it on and when identically pulsed again will turn the load off and leave it off—is nothing new. For years you've been able to buy them, complete with ratchets, pawls, escapements, walking beams, lock-in mechanisms, etc., in a regular commercial quality grade. Sequencing and stepping relays are the more educated relatives in the family.

But in the recent trend of getting more things up in the air, and generally getting more and more out of smaller and smaller relays for practically no power and under unpleasant conditions, the standard commercial impulse relay has often gotten dirty looks. Generally, it wouldn't hold together under the vibration or shock levels, and its size and relatively short life further complicated things.

Naturally, Sigma now has an impulse relay with none of the above drawbacks (mostly because it has none of the above mechanical mechanisms). SPDT contacts will switch 2 amp. resistive loads

(28 VDC/120 VAC) 200,000 times; mechanical life with no contact load is 4 million operations. It works on positive DC pulses as short as 1 millisecond, at speeds up to 10 pps. For the space, weight and power pinchers, this new hermetically sealed relay takes up 1" x 1" x 1 1/4", weighs about 2 1/4 ounces and transfers its contacts on as little as 250 microjoules (e.g., 250 mw. for 1 ms.). Vibration immunity is in the order of 30 g's to 2000 cycles, operating temperature -65° to +125°C. About the only caution is that you've got to feed it pulses of the same polarity.

We're building this little marvel and even have a few anxious customers. People who build telemetering equipment, satellites, and perhaps computers as well, are the Sales Dept's. great white hope. If you like binary counting schemes and such, think of the possibilities if you hooked up several in sequence. And with a small roulette wheel and an acquisitive impulse, one might do handsomely, mightn't one?



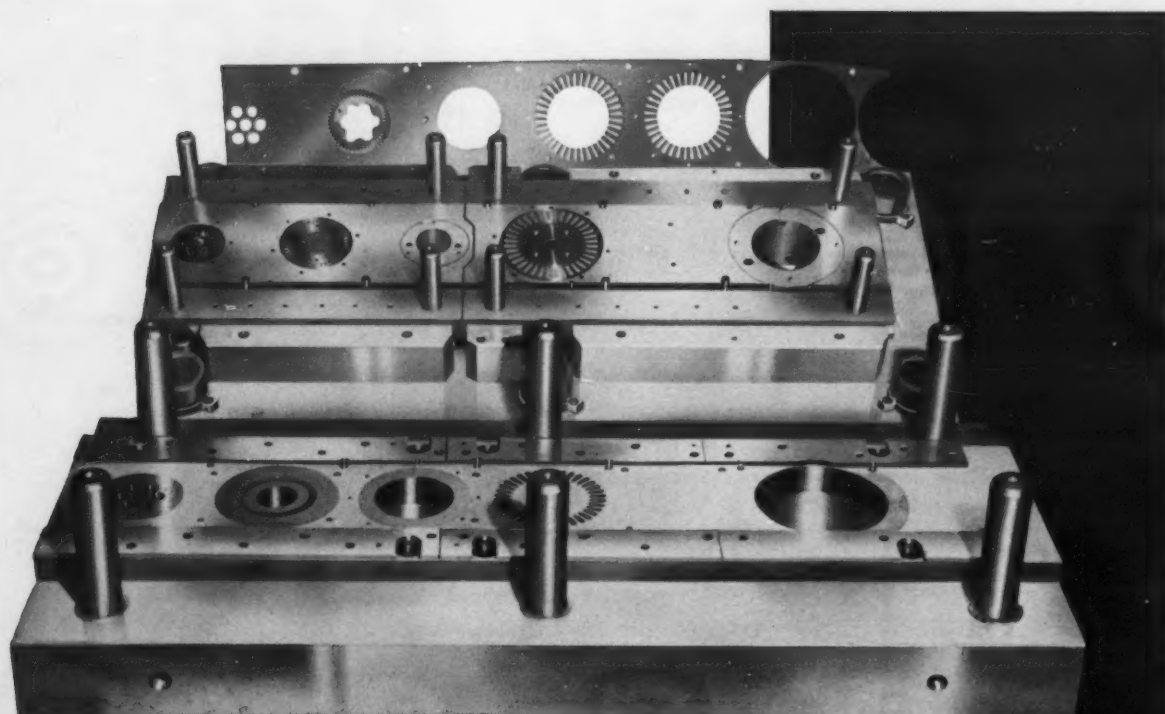
SIGMA

SIGMA INSTRUMENTS, INC.

53 Pearl Street, So. Braintree 85, Mass.

AN AFFILIATE OF THE FISHER-PIERCE CO.

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LAMINA CARBIDE DIES with Lamina-Bronze Guide Pin Bushings

Carbide dies designed and built by Lamina assure full realization of your production requirements. Lamina-bronze guide pin bushings are wring-fit in the die shoe to provide distortion-free, full-bearing surfaces that result in better die alignment, less maintenance and longer die life. For more accurate press operation, higher production and lower costs—standardize on Lamina dies and details.

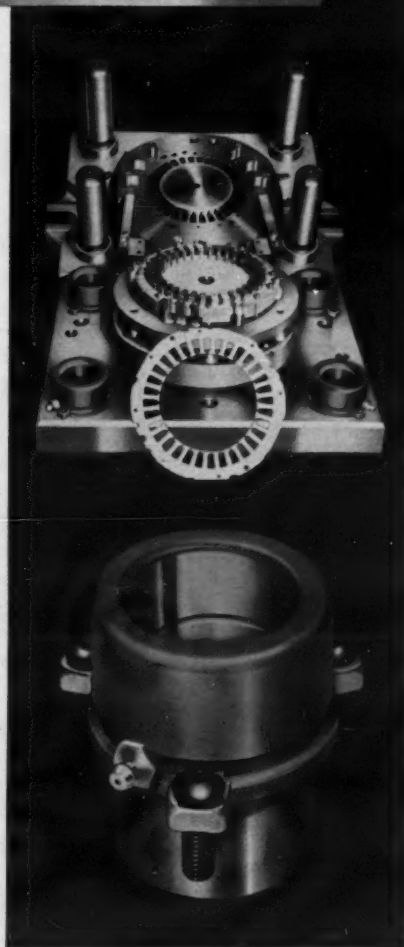
Lamina

DIES AND TOOLS, INC.

P. O. BOX 31, ROYAL OAK, MICHIGAN

WE WOULD BE PLEASED TO QUOTE
ON YOUR CARBIDE DIE REQUIREMENTS

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IDEAS...

MECHANICAL DEVICES

Separately Powered Eccentrics

Lars G. Soderholm, Midwest Editor

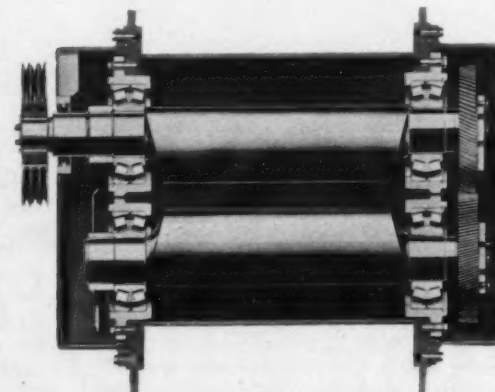
A new type of vibrator drive mechanism makes use of two independently driven eccentrics, each with its own electric motor, to provide the high-intensity straight-line motion required. Within seconds of their start they become synchronized and operated together, although not coupled.

The conventional method of obtaining the straight-line vibrating motion in feeders and screen conveyors is through the use of a Buhler-type drive. In this type of drive two eccentric shafts are joined by a set of gears to maintain synchronism.

The new vibrator drive eliminates gearing entirely. Two general explanations exist for the self-synchronizing effect of this drive. Both assume that the two equally unbalanced shafts rotate in opposite directions on a rigid frame that is resiliently supported. Also, an independent means of producing rotation is used so that the shafts are free to move relative to each other.

First, any driven member will react to a driving force along the path of least resistance. Any out-of-phase relationship will impart translational and rotational movement to the frame—the sum of which is greater than the straight-line movement resulting from the synchronous operation. The shafts will seek a phase relationship which will produce only a straight-line vibratory movement.

The second explanation assumes that any out-of-phase operation of two counter-rotating unbalanced weights will produce a synchronizing force

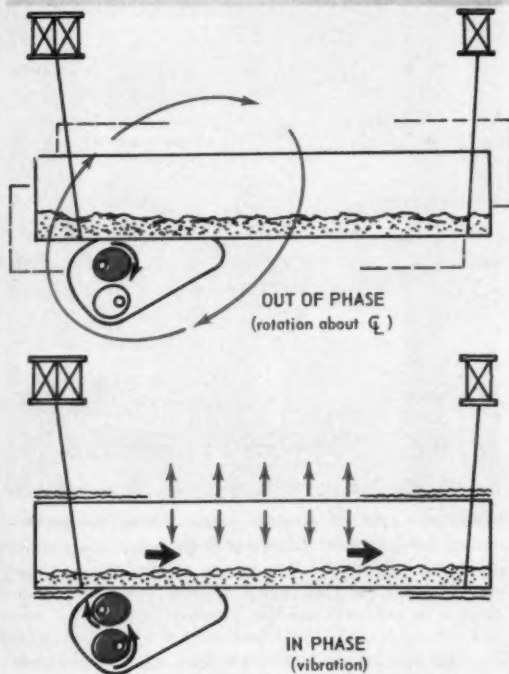
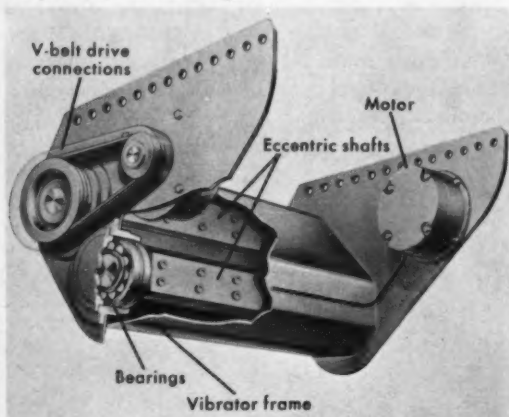


CONVENTIONAL VIBRATING MECHANISM found on vibrating feeders.

Hold Synchronism without Gears

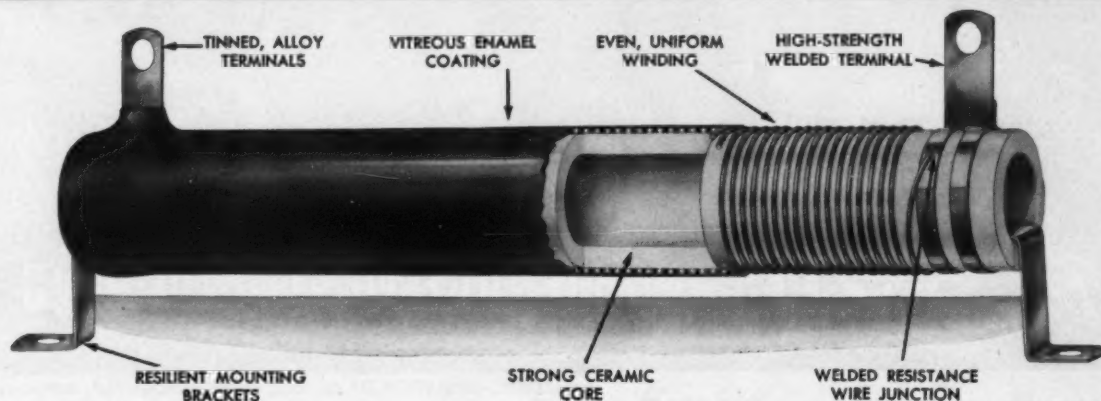
in a direction perpendicular to the direction of straight-line motion. This synchronizing force tends to rotate the frame about its center of gravity, producing vibration.

The synchronomatic vibrator can be had on straight-line vibrating feeders and screens up to 1350 tons per hr capacity, manufactured by the Link Belt Co., Chicago, Ill.



NEW VIBRATING MECHANISM consists of two rectangular shafts with eccentric weights bolted in place. Shafts are turned for bearing mounting at each end. Each shaft is V-belt connected to own pancake-type electric motor.

Quality Features of **OHMITE** VITREOUS ENAMELED RESISTORS



Balanced Thermal Expansion prevents crazing and moisture entrance

In Ohmite resistors, spot welding replaces soldering, brazing, and mechanical fastening. Spot welding produces strong connections that are not affected by vibration or high temperatures. Ohmite welded construction also produces an almost flush connection between the resistance wire and terminal. This prevents thin spots or bulges in the vitreous enamel coating which might cause future trouble and failure. Many different types of terminals are available besides the lug illustrated.

Ohmite can supply all of your resistor needs

some of the many types available

Axial Lead	Live Bracket Mounting Resistors
Brown Devil® Wire Lead	Edison Screw Base Mounting Resistors
Fixed, Lug Type	Riteohm® Wire-Wound Precision Resistors, Encapsulated; Vitreous Enamelled; Molded Jacket; Hermetically Glass Sealed
Dividohm® Adjustable	Riteohm® Metal Film Resistors
Thin Type	Resistors to meet MIL Specifications
Noninductive	High-Shock Resistors
Powr-Rib®, High Current, Round or Ribbon Wire, Open Wound	
Corrib®, High Current, Corrugated, Edgewound Ribbon	
Resistors with Heat Conducting Studs	
Ferrule Mounting Resistors	

The almost endless variety of Ohmite resistors in many sizes and types—in a wide range of wattages and resistances—makes it possible to meet each individual need. Many of these can be supplied from the world's largest factory stock. Whatever your resistor requirements may be, chances are you will find exactly the type you need in industry's most complete line of high-quality resistors.



OHMITE MANUFACTURING COMPANY
3616 Howard Street
Skokie, Illinois

RHEOSTATS RESISTORS RELAYS
TANTALUM CAPACITORS TAP SWITCHES
VARIABLE TRANSFORMERS DIODES R.F. CHOKES

Write on company letterhead for Catalog 58

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Relief valve, using VITON O-ring, vents excess pressure from transforme.

The ideal pressure-sensitive relief valve for sealed, oil-filled transformers should be "selective." It should withstand normal pressure changes, yet respond quickly to emergencies.

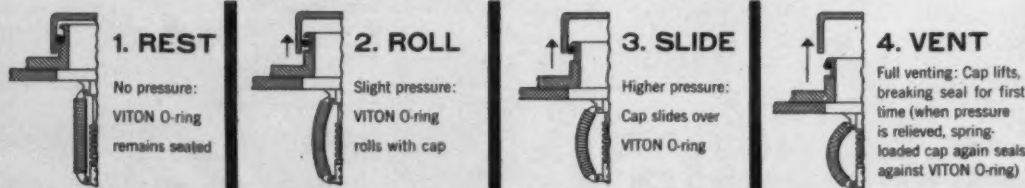
General Electric's Medium Transformer Department at Rome, Georgia, designed a mechanical relief valve that would not only solve this problem of selectivity, but would actually reset itself after discharge. The valve's success depended on an O-ring able to maintain a tight seal in spite of repeated exposure to hot insulating oil. With an O-ring made from VITON synthetic rubber, this novel spring-loaded relief valve has proved itself both faster and more reliable than previous devices*.

*Case history from the ELASTOMERS NOTEBOOK—subscription free on request.

OTHER APPLICATIONS OF VITON

VITON'S outstanding resistance to heat, oil, fuels, solvents and chemicals has improved the performance of a wide range of industrial equipment. O-rings, packings and seals have been molded from VITON . . . tanks have been lined, fabrics have been coated and wire has been jacketed . . . all with VITON. If you have a problem involving high temperatures and corrosive fluids, VITON will serve where other elastomers fail. See your rubber goods supplier for information, or write for our booklet of specific data, with current and suggested applications. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-2, Wilmington 98, Del.

HOW RELIEF VALVE USES VITON O-RING



Better Things for Better Living . . . through Chemistry

VITON®
SYNTHETIC RUBBER

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IDEAS . . .

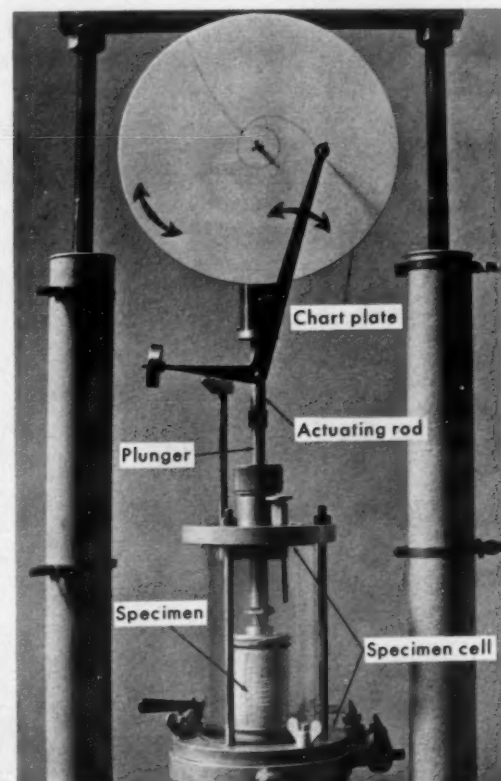
MECHANICAL DEVICES

Load/Strain Recorder

Ronald W. E. Martin, British Editor

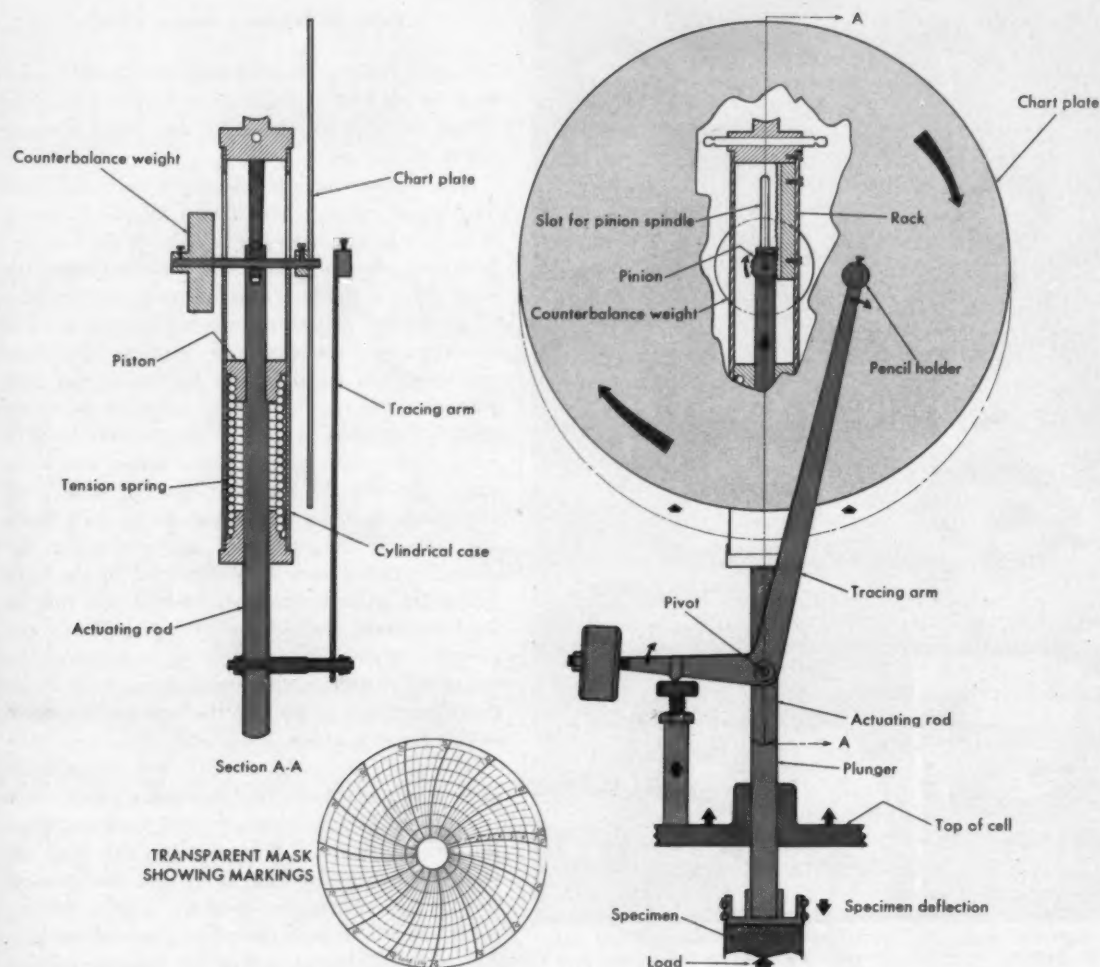
PROBLEM

Compression tests on cylindrical soil specimens require both a constant circumferential pressure (supplied pneumatically) and an axial stress which is increased until failure occurs. Axial load is measured normally by a proving ring, whose deformation is indicated on a dial gage. Specimen deflection is measured by a second dial gage. Both gages must be read at regular intervals. Since some tests take several days, observation becomes a problem.



PHOTOGRAPH of recorder taken during compression test on soil specimen. Trace drawn by pencil is visible on chart plate. On completion of test, tracing arm is swung clear and circular transparent mask is fitted on spindle. Mask is rotated until zero line intersects beginning of trace and deflection of specimen and load on it at any stage of test can then be read off from lines inscribed on mask. These comprise two sets of lines: a series of concentric circles indicating deflection and a set of radiating arcs indicating load. Circles and arcs are constructed from information obtained from a calibration test. Maximum deflection recorded by instrument is 0.8 inch and maximum load is 150 lb.

Plots Single Continuous Curve



SOLUTION

In a new recorder, axial load rotates a dial; specimen deflection swings a pencil across the dial face. Thus, a trace is produced which records both load and strain simultaneously. An observer is not required.

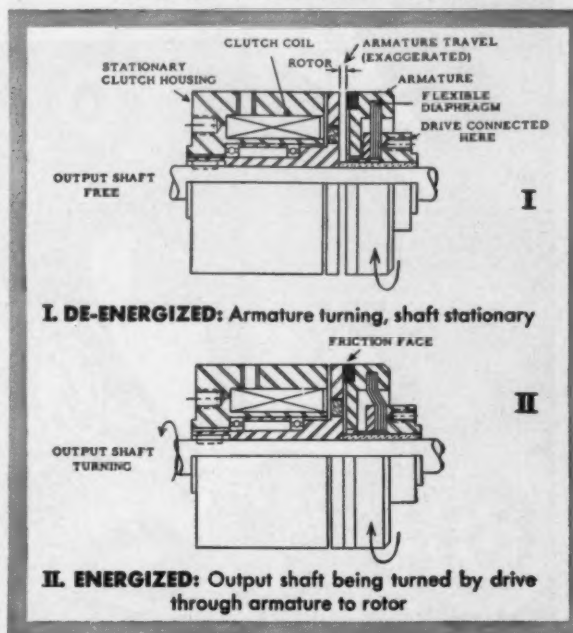
In operation, load is applied by hydraulic ram to the under side of the specimen cell and is measured by a tension spring on top. The lower end of the spring is held in its cylindrical case. The upper end attaches to a coaxial actuating rod which is in direct contact with the specimen. As load increases, the spring stretches and a pinion at the top of the rod runs up a rack inside the case. The pinion spindle protrudes through both sides of case and carries a white perspex chart plate at one end, a counterbal-

ance weight at the other. Spring extension rotates the plate, with angle proportional to spring load.

The lower end of the actuating rod rests on a plunger acting on the specimen's upper end. Deflection is measured by an L-shaped tracing arm, pivot-mounted on the rod. Shorter leg of the arm rests on a lug on top of the cell containing the specimen; the longer arm carries the pencil, writing on the chart plate. During specimen deflection after application of load the plunger and rod descend, causing tracing arm to describe an arc on the chart plate. The length of this arc is a measure of the deflection of the specimen.

The autographic recorder was designed by E. Spencer, M.Sc.Tech., Manchester College of Science and Technology, Manchester, England.

Choose A Diaphragm Electric Clutch for Superior Performance Lower Installed Cost



Like most really sound engineering ideas the practicality and economy of electric clutches and brakes without the conventional sliding armature had to be proved in practice.

Now, a few short years after their introduction, Simplatrol electric clutches and brakes have proved that their design, based on a flexible diaphragm in the clutch's armature, does do a better job than armature plates sliding on splines, pins, or hubs.

Simplatrol's armature, a one-piece assembly, deflects to perform clutching or braking action. Wear is reduced to vanishing point since there are no sliding parts to contact each other; instant performance is achieved without slow release, or "hanging up."

This Simplatrol diaphragm principle ensures smoothness, quietness, and consistency.

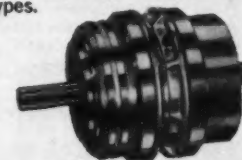
Compare the installed cost.

Simplicity carries through to the installation, reducing cost here as well. You simply slip one of the 2 or 3 major assemblies onto the shaft — that's all the assembling you do! No pins, no nuts, no washers, no springs to run up labor cost.

Machined parts in the clutches and brakes are of uniform quality. There's close built-in control of tolerances and finishes . . . and the assemblies are pre-burnished! All clutches include bearings, machined surfaces and bolt holes for direct mounting of your drive unit.

Simplatrol offers a complete range of diaphragm electric clutches from torque of 10 ounce inches to 470 pound feet in diameters from 3/8" to 12 1/2". Styles include clutches, brakes, clutch-brakes, duplex clutches, and couplings in both rotary and fixed field types.

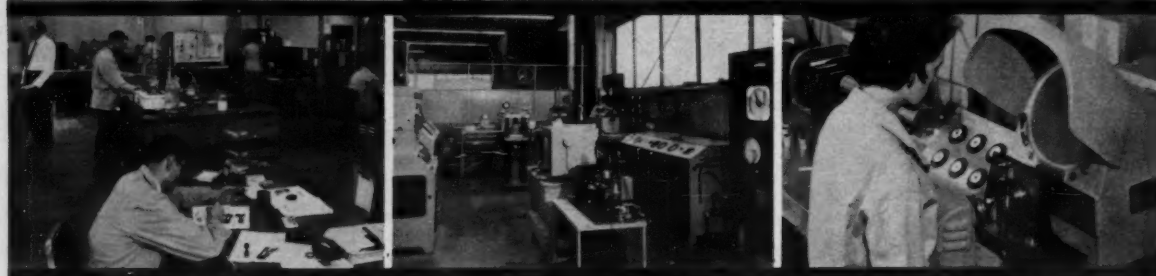
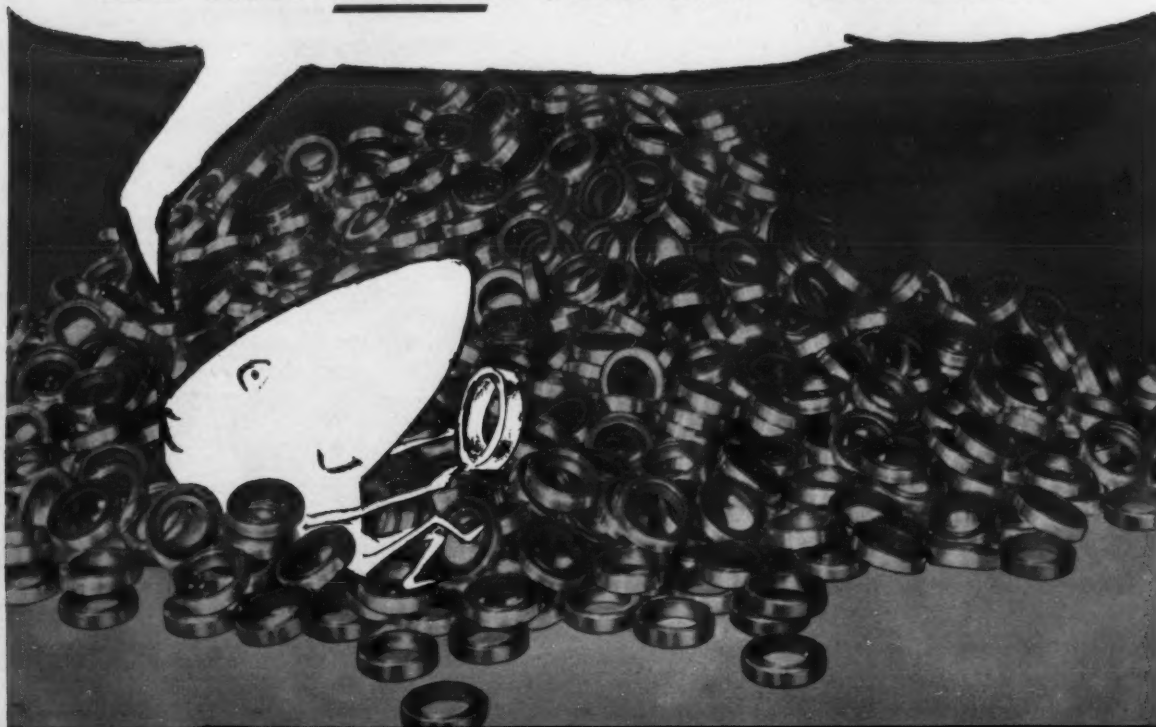
Ask Simplatrol's sales engineers to demonstrate to you specifically how the unique advantages of flexible diaphragm performance will benefit your operation.



Simplatrol products corp.
24 SALISBURY ST., WORCESTER, MASS.
Representation in Key Industrial Areas

Circle 19 on Reader-Service Card for more information

YES SIR...THAT'S "CUSTOM" CONTROL!



Control laboratory determines compound best suited to your need.

Engineering Test Laboratory check final design... establish tolerance limits for production.

"QC," Quality Control technicians are located throughout the plants to examine your parts as they're being made.

It takes more than machines to turn out a consistent, *uniform* batch of oil seals . . . That's why IPC started the highly critical "custom control system."

After engineering and lab analysis a specific recommendation of

manufacture is made for *your* oil seal. Critical tolerance levels are established to guide the many Quality Control people who will follow your parts as they move through our plants. At any time, our QC department can halt pro-

duction if they find variances in manufacture.

Result? . . . *Uniformity* . . . the assurance that IPC is controlling quality for you.

We would be happy to show you this model system at work.



OIL SEALS
PACKINGS

PRECISION MOLDING

/ Custom designed for your application

INTERNATIONAL PACKINGS CORPORATION

© IPC

Bristol, New Hampshire

P1

Circle 20 on Reader-Service Card for more information

IDEAS . . .

MECHANICAL DEVICES

Riveter's Foot-Trip

Victor W. Wigotsky, Eastern Editor

A cutlery riveting machine uses the normal movement of the foot trip as a safety device. This eliminates necessity for guards or any other separate safety provisions.

The single machine assembles both the male and female rivet in less than a second. A clamp is located to seat the tubular rivet in the counter-bore and maintain the knife position while the solid rivet is driven. This normally would be a safety hazard. Guarding was impractical since it would reduce the space for loading. To avoid restricting the work area or increasing the complexity of the machine with a separate safety device, the normal movement of the foot strip is used to carry the clamp onto the knife. The automatic cycle of the machine can not start until the clamp reaches a position about $\frac{1}{8}$ inch above the knife. If the operator's finger is under the clamp, it can then only be squeezed by the light preloaded spring, which is the foot trip linkage used to lower the clamp. However, when the clamp reaches approximately $\frac{1}{8}$ inch above the top of the handle, a valve controlling clamp cylinder is energized to provide the high-force portion of the clamp's stroke.

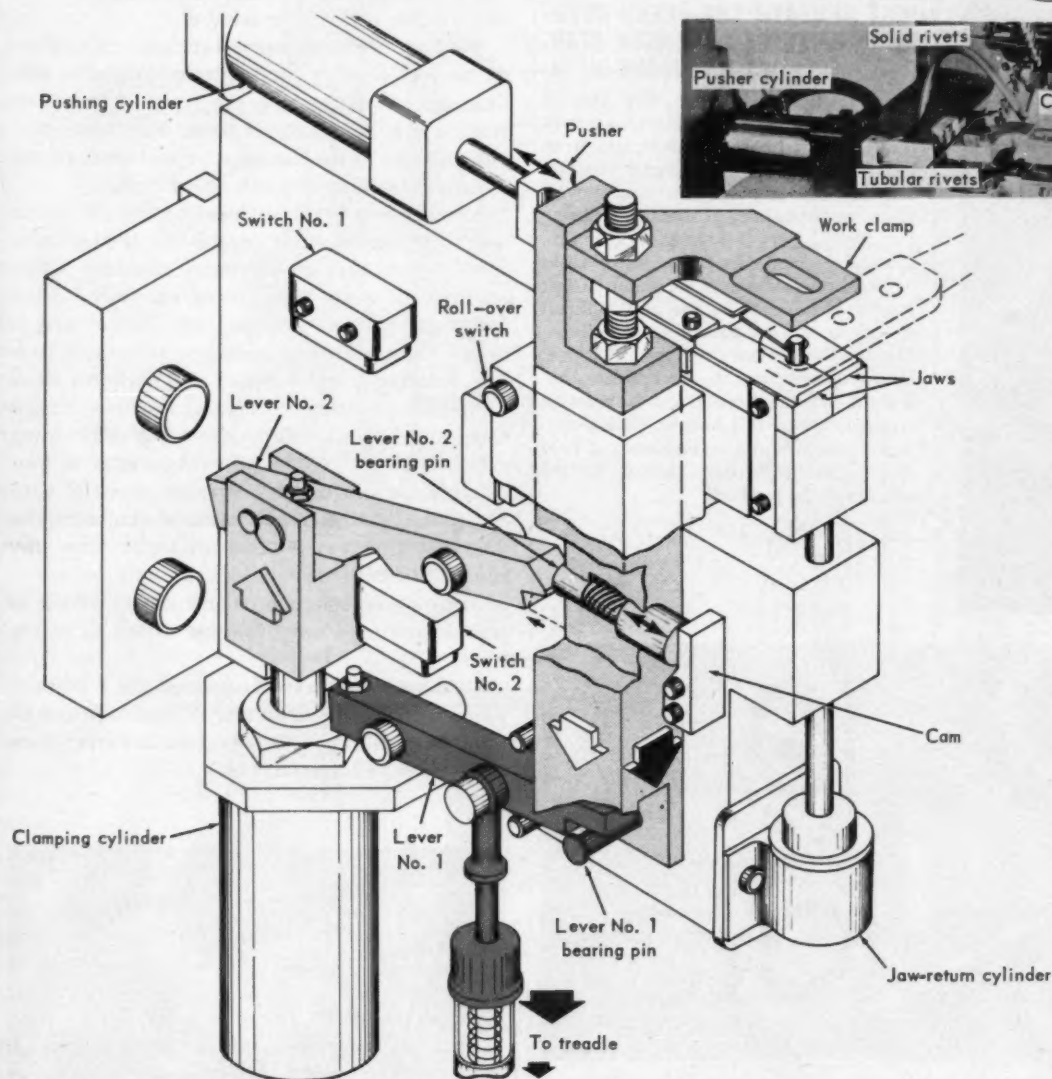
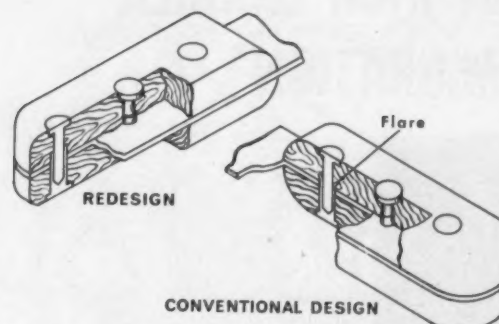
The single unit does the job that normally required two machines and has some other basic advantages. Normally, when using two machines, the two halves of the handle and the tang are loaded on a spring pin anvil and the tubular rivet is driven into the assembly. This semi-complete assembly is then moved to a second machine where the solid rivets are driven into the tubular ones. In order to hold the semi-complete assembly together during transit to the second operation, the tubular rivet is usually flared. This, however, reduces the holding power of the male rivet, by decreasing the length of the press fit bearing in the tube. In addition, the two machines required twice the floor area, as well as locating fixtures on the unit feeding the solid rivet.

The new single riveting machine now feeds and sets both the male and female rivets. Following loading of the handles and tang on the female rivet, the cycle is completely automatic.

The Model No. 111 Cutlery riveting machine was designed by Tubular Rivet and Stud Co., Quincy, Mass.

Doubles as Safety Device

SKETCH ILLUSTRATES CONVENTIONAL ASSEMBLY with flared tubular rivet. New method provides more effective press fit with solid rivet, permitted by elimination of flare required for transfer operation.



WORK CLAMP is carried down to knife by means of foot treadle. As it reaches position approximately $\frac{1}{8}$ inch above top of handle, valve which controls clamping cylinder is energized through limit switch No. 2. This cylinder provides high force portion of clamp's stroke needed to cam jaws off head of tubular rivet to permit seating it into counterbore of handle. Solid rivet is then driven by mechanical cycle initiated by limit switch No. 1 through solenoid. Clamping cylinder

is de-energized at completion of driver's downward stroke. Clamp is automatically raised $\frac{1}{8}$ inch above knife and returns to its starting position when treadle is released. Jaws for tubular rivet are returned to loading position by small air cylinder used as pneumatic spring. Pusher cylinder is then energized, carrying another tubular rivet to loading position and ejecting knife.

Calibrated, Dual Switch TEMPERATURE CONTROL

B27A



TYPE
B27A

United Electric's Type B27A Temperature Control is a local mounted, enclosed unit that has been designed for applications where it is desirable to control two separate circuits at different temperatures by means of a single control unit. Independent switch adjustments provide a maximum span of approximately 20° F between switch settings, and this span is constantly maintained throughout the control range.

Adjustable Range	Ranges of 50° or 100° F. between limits of 50° and 400° F.
Maximum Difference Between Switch Settings	Approximately 20° F.
Switch Ratings	Up to 15 amps. at 115 or 230 volts A.C. 20 amp. A.C. or D.C. switches also available.
Switch Types	N.O., N.C., or double throw — no neutral position.
Adjustments	By rotating a single turn knob and pointer against a calibrated dial. Individual screw adjustments on switches for adjusting span between switch settings.
Electrical Connections	Via $\frac{3}{8}$ " diameter clearance hole and an internally mounted terminal board.
Mounting	In any position by the $\frac{1}{2}$ " NPT on the immersion element.
Enclosure	Cast aluminum case with black wrinkle finish. Bright-dipped brass immersion element.

UNITED ELECTRIC manufactures a complete line of temperature, pressure, and vacuum controls. For special applications, standard units may be modified, or custom-built units may be provided.

For additional information on local mounted temperature controls, including Type B27A, request Section 100 of our new catalog.



**United Electric Controls
COMPANY**

85 SCHOOL STREET, WATERTOWN, MASS.

Circle 21 on Reader-Service Card for more information

75-MILLIONTHS OF AN INCH BARRIER HALTS METAL MIGRATION



JUST BENEATH THE FRESH OVER-PLATE OF THESE F-M ENGINE BEARINGS (LEFT) LIES A TENUOUS DIFFUSION BARRIER. Though this film of metal is only 75-millionths of an inch thin, it stops tin in the overplate from migrating into the lining metal beneath. Its presence is important to bearing over-plate performance, particularly during the critical period of engine break-in. Maintaining uniform thinness as well as uniform composition of the plated barrier is most important . . . and most difficult to achieve on a production scale. Federal-Mogul research has developed a unique, extraordinarily precise method for controlling both the thinness and the metallic composition of this barrier, within narrow limits. And the performance of F-M engine sleeve bearings attests to the success of the method!

RESEARCH INTO ELECTROPLATING problems is a continuing project in the F-M laboratories. Unusual precision equipment and facilities are employed, many of which have been specially designed and engineered by F-M to solve problems of sliding-bearing application. As a result, Federal-Mogul engineered sleeve bearings, precision thrust washers, formed bushings, and low-cost spacers provide the finest possible performance characteristics for any application.



FEDERAL-MOGUL

sleeve bearings
bushings-spacers
thrust washers

DIVISION OF
FEDERAL-MOGUL-BOWER
BEARINGS, INC.

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Have you a problem with bearings, bushings or washers? Are you considering the development or redesign of an item of the type shown above? We'll be glad to show you how the job can be done most effectively and economically. For information, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

IDEAS . . .

MECHANICAL DEVICES

Tapered Surfaces

E. J. Stefanides, Central States Editor

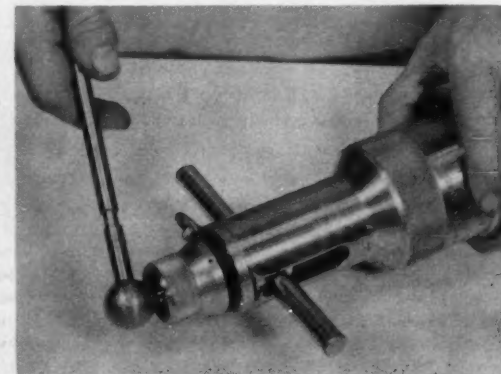
A flaring tool for flaring heavy-walled tubing uses an explosive charge to provide the flare forming and coining force. Gas pressure from the charge also provides the primary clamping pressure which holds the tube in the die.

Two sets of mated tapered surfaces are used in the tool to provide two separate actions. A self-locking taper is used on the ID of flaring cone and on the OD of barrel stem. This taper provides a delay of the flaring cone motion until the dynamic clamping action has taken place.

Another set of tapers is used on the OD of the split die ring and ID of the die holder bore. These tapers provide a primary clamping action on the tube as gas pressure on the sleeve piston forces the split die into the bore. The tubing is inserted until it bears against a removable gage pin, assuring a standardized and uniform flare.

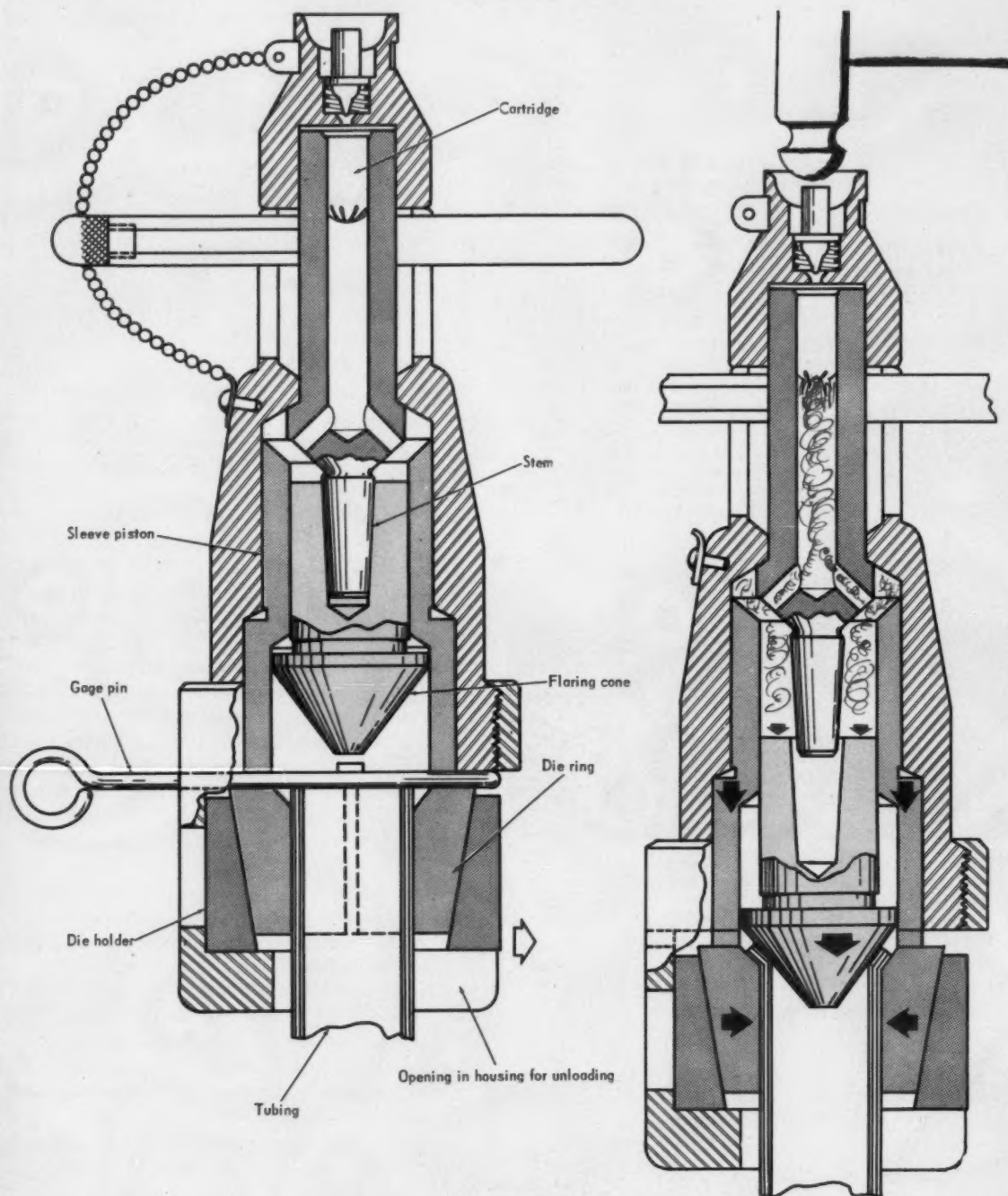
Another problem is providing exactly the right force to produce the proper forming and coining action. This is solved by providing a series of four cartridges which match the requirement of various tubing diameter and material combinations. The resulting tool will satisfactorily form and coin a standard 37-deg hydraulic flare on heavy- or light-walled steel and stainless steel tubing as well as tubing of other materials from 1/2 to 1 1/4 inches OD.

This tool has been designated the "Ballistic Flarer". It was designed and is manufactured by the Parker Fittings and Hose Div. of Parker-Hannifin Corp., Cleveland, Ohio.



BALLISTIC FLARER is cartridge-activated device for forming SAE hydraulic 37-deg flare (JIC standard).

Clamp Tubing in Ballistic Flaring Tool



FLARING CONE is jammed into mating taper of barrel stem; tubing then is inserted until it stops against gage pin; housing is tightened, supplying initial tube clamping. Pin is removed, cartridge inserted and breech block tightened down.

Cartridge is fired by light hammer blow; gas drives sleeve piston down, seating split ring in die holder taper which clamps tube. Gas pressure build-up breaks locking taper in cone shank; flare is formed by impact of cone.

...let these hands



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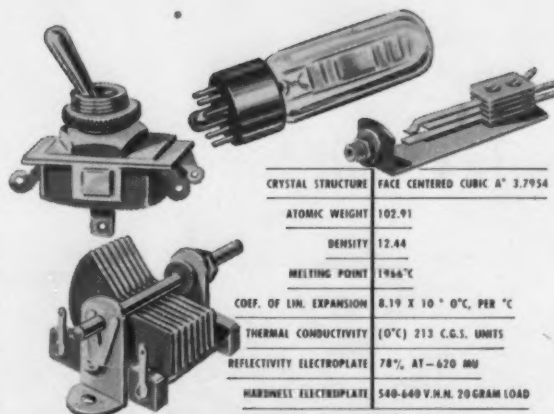
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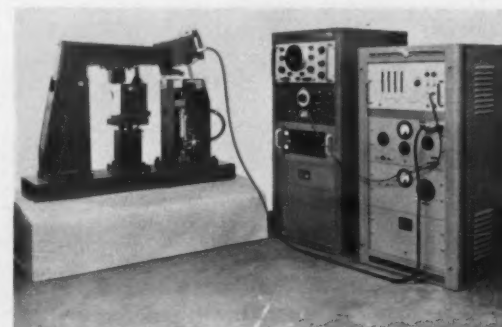
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IDEAS...

MECHANICAL DEVICES

Motor Mount Tester

Lars G. Soderholm, Midwest Editor



A motor mount tester finds the dynamic spring rate of engine mounts and vibration absorbers by using electromechanical transducers to indicate the phase angle between the forces and displacement of the oscillating rubber sample. At natural frequency the displacement of the mount and the force applied are exactly 90 deg out of phase.

The dynamic spring rate is found from the equation $K = \omega^2 / M$ where K is the dynamic spring rate, ω the natural frequency and M the mass of the known load.

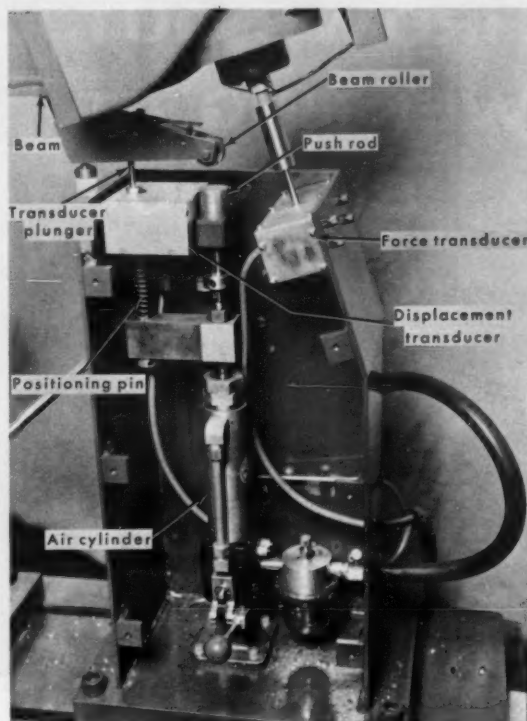
The vibration tester's variable-frequency electrical input equipment consists of a low-frequency oscillator, an amplifier for the low-frequency oscillator signal, a d-c amplifier to supply the field coil voltage to the vibration exciter and an electronic counter. The low-frequency oscillator amplifier drives the armature of the vibration exciter so a maximum of 10 lb of alternating force is available. The electronic counter is used to measure the period of oscillation of the signal generated by the audio oscillator. Period readout is more accurate than frequency count at the low frequencies (5-30 cps) used.

The force-measuring transducer is connected to the horizontal input of the oscilloscope while the displacement transducer is connected to the vertical input of the oscilloscope. When a sample is vibrated, an elliptical pattern is displayed on the face of the scope. The ellipse will be tilted to one side or the other unless the vibration is occurring at the natural frequency. Adjusting the oscillator dial causes the pattern to tilt from side to side.

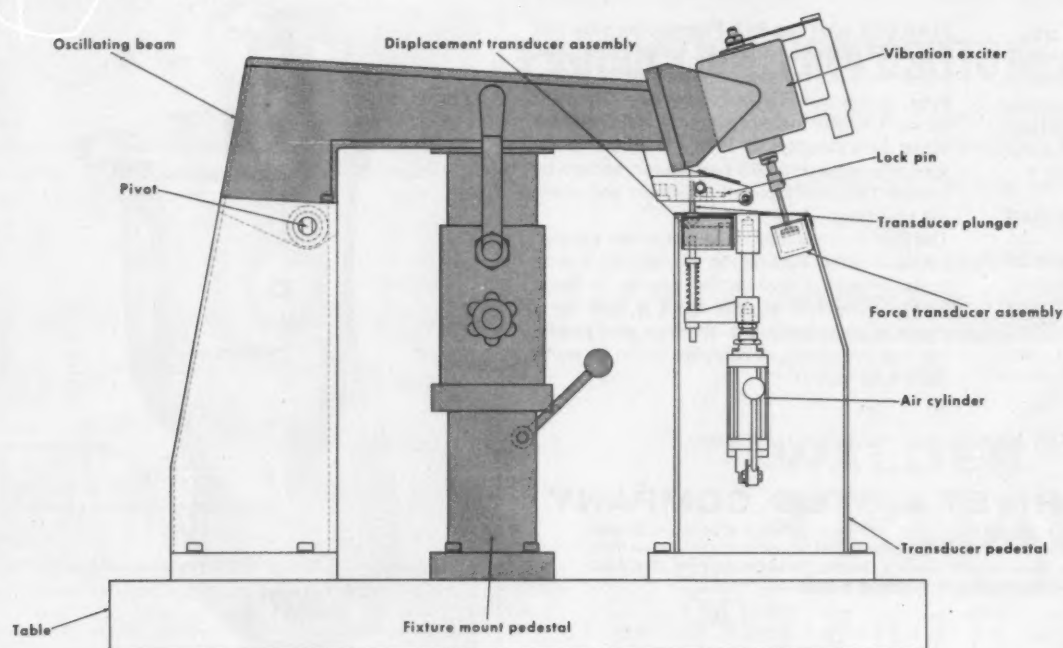
The Model 652-2 motor mount tester, which is a commercial version of the Chrysler-developed vibration testing machine, was engineered and built by Mast Development Co., Davenport, Iowa.

Finds Dynamic Spring Rate through Natural Frequency

RAISING OSCILLATING BEAM is necessary to change test sample. Beam is raised by air cylinder which lifts end of push rod. As push rod goes up, it lifts positioning pin until positioning pin collar contacts bottom of displacement transducer assembly. Positioning pin is then supporting cantilever beam in transducer. Further movement of air cylinder push rod raises beam roller which pivots entire assembly and pulls away locking pin from transducer plunger. This allows transducer plunger to rest on displacement transducer beam as oscillating beam is raised to position. In lowering beam, transducer plunger is not locked in place again until test sample has taken weight of beam and locking pin swings in place as push rod end pulls away from beam raise roller. Positioning pin then drops down, leaving transducer ready for test.



RUBBER SAMPLE VIBRATION TESTER consists of horizontal beam pivoted at one end. Free end has electrical vibration exciter. Electrical vibration exciter applies alternating force at low frequencies. Force transducer assembly consists of short beam with ends clamped and center of beam attached rigidly to armature of vibration exciter. Four strain gages attached to upper and lower sides of beam are wired to form bridge circuit. Output leads from strain gages are connected to horizontal input of oscilloscope. Displacement transducer assembly consists of cantilever-type beam with strain gages attached to tension and compression sides of beam. Displacement beam has low spring rate so it does not add to spring rate of sample. Signal leads from displacement transducer are connected to vertical input of oscilloscope.



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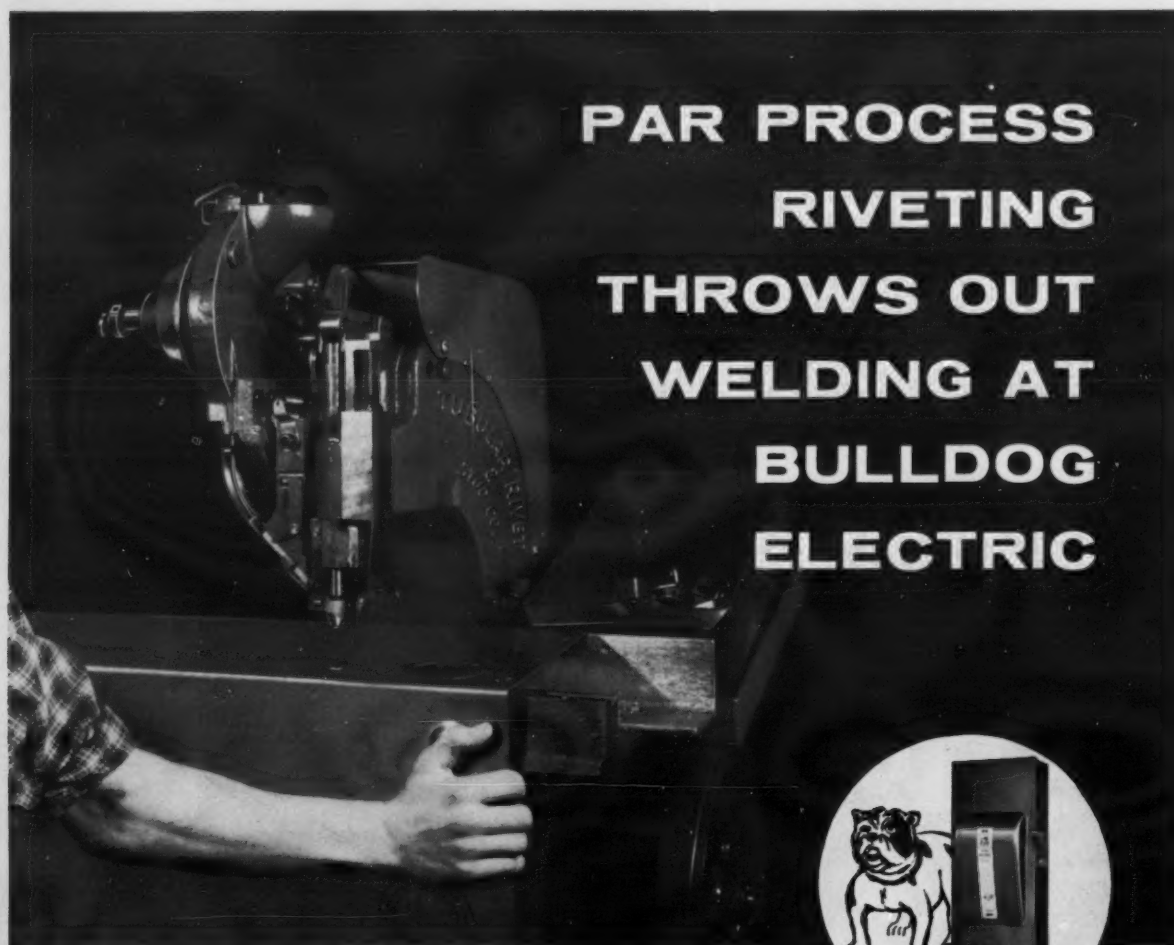
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PAR PROCESS RIVETING THROWS OUT WELDING AT BULLDOG ELECTRIC



Cuts Assembly Costs 65%

At Bulldog, TRS riveting replaced arc welding in assembling components of Vacu-Break® safety switch boxes... with an overall saving of 65% in assembly costs. Previously, twelve arc welds were used to secure the two spring stops and mounting rails of each switch box. Special fixtures were required to support parts in the box during welding, and after welding was completed the fixtures had to be dismantled. The entire operation was costly and time consuming.

Trained in the PAR Process approach to cost reduction, the TRS man saw that an automatic riveting set-up could be devised to simplify and speed the work. A roller support was designed to carry the weight of the box, and position the parts for twelve fast operations of a standard TRS automatic riveter. Other details of rivet design, tooling, and setting sequence were quickly solved with the aid of PAR Process know-how. Riveting produced an equally strong assembly and permitted visual inspection of fastenings to assure security.

FIND OUT what the PAR Process can save you. The PAR Process aims at lower costs and higher production rates. It starts with a sharp-eyed, production line search by your TRS man, for ways to eliminate or simplify and speed up steps in assembly. It is made effective by specially organized TRS procedures, backed by unique TRS developments in rivets and riveting machines.

The PAR Process may bring you better integration and fuller automation of assembly operations, or even a cost-cutting change in basic assembly method as with Bulldog. Ask for a check of your operations. Whether your assembly jobs are simple or complex, it can be worth dollars to you.

Don't Buy Riveting Machines until you learn how the TRS PAR process revolutionizes riveting

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QUINCY 70, MASSACHUSETTS • TRS SALES OFFICES: Atlanta • Buffalo • Charlotte • Chicago
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See "Yellow Pages" for phone numbers.

If it's a Tubular Rivet TRS makes it... and Better



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IDEAS...

MECHANICAL DEVICES

Submerged Vibrator Pump

G. Bernard, Correspondent in France

Locating all pump components as well as the main power piston inside the oil reservoir makes a compact and trouble-free electro-hydraulic servo actuator for remote installation. Lubrication and contamination problems are almost eliminated. The actuator provides a linear mechanical displacement of the output shaft to control mechanisms.

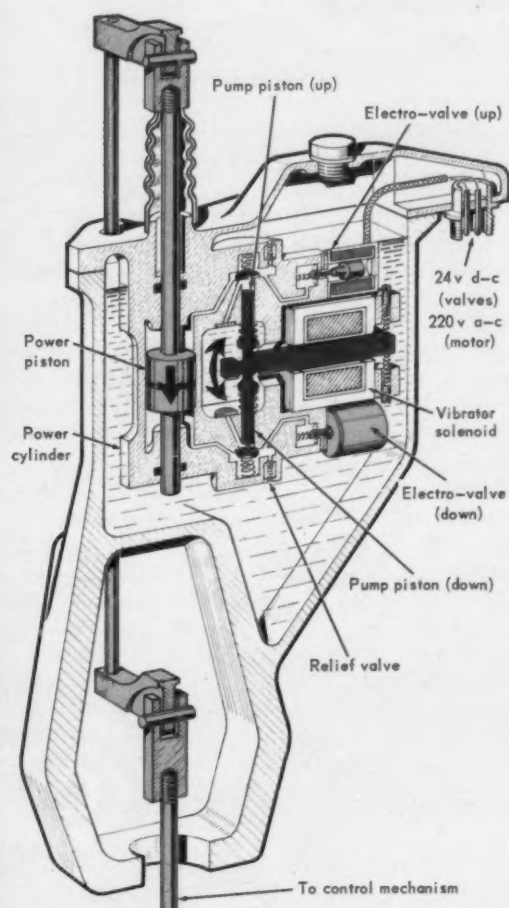
Pumping power comes from a vibrator which pivots a spring-damped armature at line frequency. At one end, the armature is fastened by a ball-joint to the middle of the double-acting pump rod. Each end of the rod acts as a separate piston pump, supplying oil to its respective side of the power cylinder.

To move the power piston, oil pressure is bled away from one side by energizing an electromagnet, which in turn opens a spring-loaded ball valve. Normally the pump does not operate when neither bleed valve is open, but if this should occur, spring-loaded relief valves open to return oil from both both branches to the surrounding tank. With pump and control valves de-energized, the power piston is locked.

Design and manufacture is by Messier Co., Montrouge (Seine), France.



Powers Hydraulic Servo Actuator



ACTUATOR comprises minimum of parts and these are simple. Wear is reduced by complete submersion in oil, which lubricates and transmits power. Whole unit can be sealed hermetically for explosive environments, such as refineries.

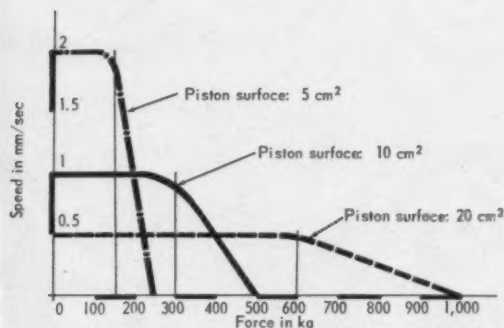


DIAGRAM shows speed of operation of various-sized pistons, plotted against the forces available.

Truarc Rings  ... installed with these Truarc tools  ...enable Revere Camera Co. to speed assembly  ...and improve servicing of its tape recorders.  Result: Revere now uses Truarc rings on all its quality recorders, cameras and projectors.

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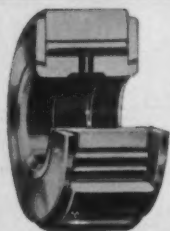
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IDEAS...

MECHANICAL DEVICES

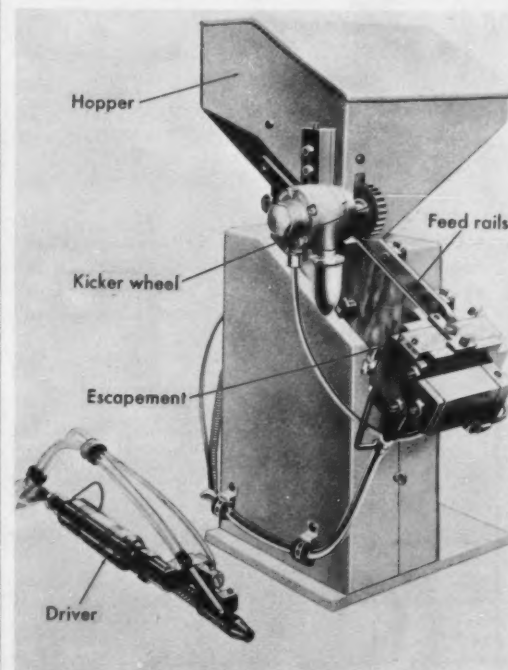
'Building-Block' Feeder Design Allows Quick Size Change

Victor W. Wigotsky, Eastern Editor

A simple "building-block" escapement, which includes a "Lucite" carry slide, is used in a new screw feeder-driver. Unit is convertible for a range from No. 2 through No. 14 screws with little required modification. Also, the slide material adds visibility to the feeding operation.

The escapement's screw carry slide contains an internal cut-out to suit a specific head diameter. A stationary insert provides a guiding track for the feeding of the screw to a hose connector. During automatic cycle, the cut-out in the slide permits one screw to be fed to the driver's delivery hose, while the next screw is held back against a shelf in the slide. This permits a continuous and positive feeding action which coordinates dropping of a screw into the delivery hose with the driving of the previous unit.

The JS-60 Jet Setter was designed by Parker-Kalon Div. of General American Transportation Corp., Clifton, N. J.

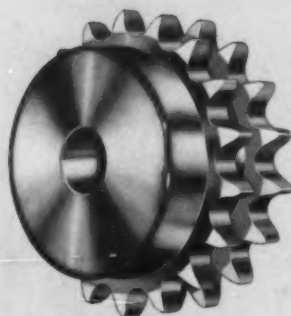


AIR CYLINDER REPLACES elaborate linkage to operate escapement. Elevator carries screws upward into feed rails.



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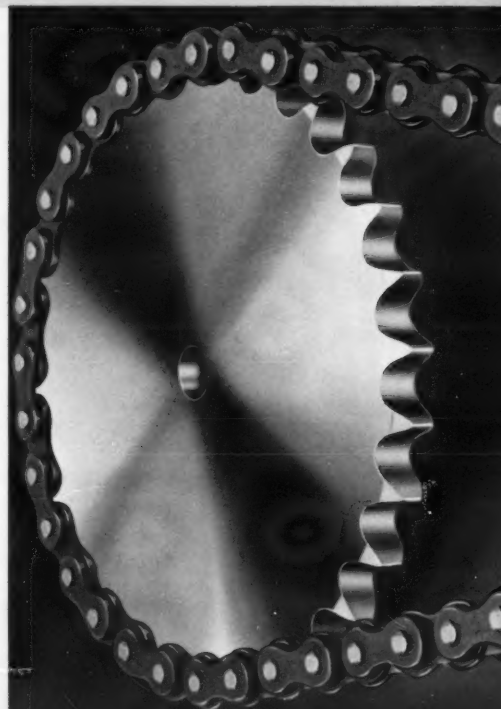
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"2000 Per Hour Contest"

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10 special awards of \$25.00 each

This is sort of a sneaky way to get you to think of applications for Avdel's Chobert Blind Rivet System. And why not? If you can tool up to set 2000 blind rivets per hour — think of the increased production and higher profits — so — you can be a hero and also win a prize.

The Automatic High Speed Riveting Gun holds a mandrel of up to 65 rivets, each automatically held ready for installation as fast as

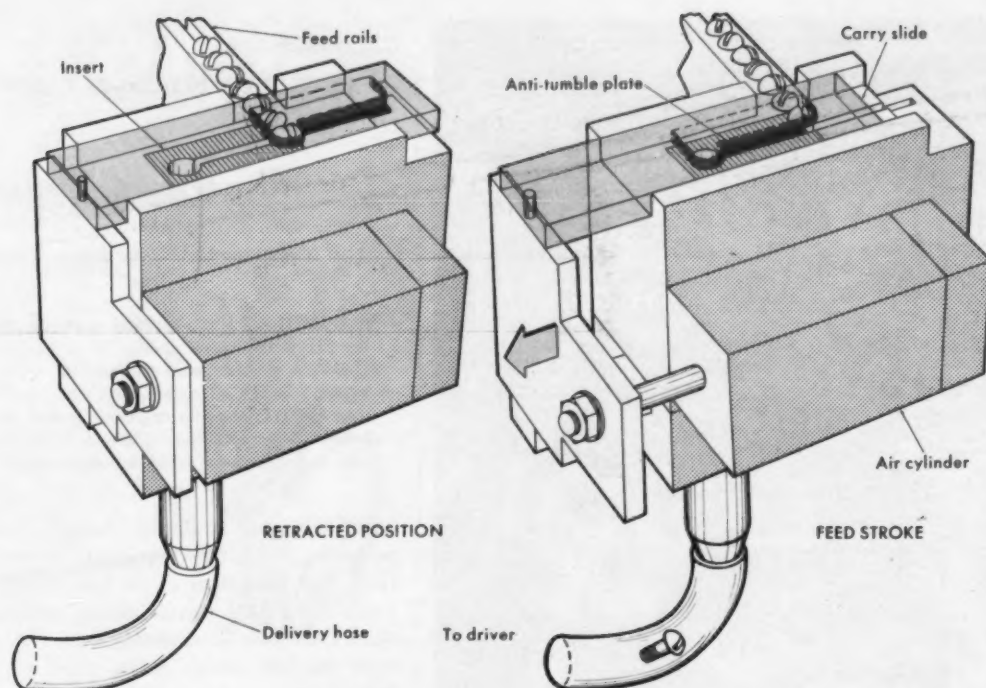


the operator can position the portable gun. Don't worry about: — "hard-to-get-at" applications — special conformations — rivet alloy — Avdel's Chobert System can whip them all and still set 2000 blind hollow rivets per hour. Think of — metal to wood — cloth to metal — as well as metal to metal fastening applications. It's easy... wherever SPEED is an ESSENTIAL condition of a rivet-fastening application... Avdel's Chobert System shines.

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1. Submit as many entries as you wish.
2. Submit your entries on your company letterhead, if available to you; otherwise on 8½x11 white paper.
3. Each entry shall include *all* the following information:
 - a. What applications your company now has for rivets of any kind.
 - b. What your idea is for a prize-winning application using Avdel's 2000-per-hour Rivet System. Simply and clearly describe this application, the materials to be fastened, and the industry or industries in which the application can be used.
 - c. State your name, address, occupation, and your title or job description in your company.
 - d. Your entry need not necessarily be an application usable only in your own company. If you *know* of an application in another company which can use Avdel's 2000-per-hour speed to advantage, describe this application, and submit the name, title, company and address of the individual and company who should be interested.
 - e. The more uses to which your idea may be put, and/or the newer the use, the more your chances increase to win important prizes.
4. All entries become the sole property of Avdel, Inc., to be used by them in any manner they see fit, including the use of your name, picture, and application idea in future advertisements.
5. The decision of the judges is final; and no employees or relations of Avdel, Inc., or its advertising agency, are eligible.
6. All entries must be postmarked not later than April 15th, 1961.
7. Send all entries to AVDEL®, Inc., 210 So. Victory, Burbank, California.

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CARRY SLIDE receives two screws into its deep well. Escapement air cylinder begins its stroke when driver bit contacts screw. Screw is carried in deep well of slide and drops through hole in insert to delivery hose. Second screw, held between feed rails and holdback shelf, drops into well when slide returns for next stroke.



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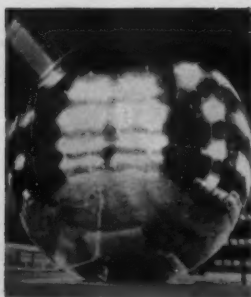
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For example, "Mylar"® polyester film gives many products extra resistance to heat, cold and aging... lengthens their life. Today, "Mylar", with its resistance to chemicals and moisture, is improving the performance of products as different as surgical bandages and intercontinental ballistic missiles.

Can this unique plastic film and products made with it help you? For more information on "Mylar", write the Du Pont Co., Film Dept., Room S-8, Wilmington 98, Del.



Better Things for Better Living... through Chemistry

*"Mylar" is Du Pont's registered trademark for its brand of polyester film.



IDEAS...

MECHANICAL DEVICES

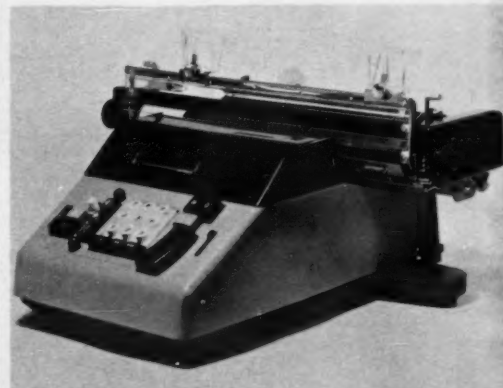
Rotating Drum Supersedes

Celestino O. Lubatti, Italian Editor

SLOTTED DRUM facilitates rearrangement of master plates for quick change of accounting program. Crankpin permits manual face-disc swing to release master plates. Coil spring pulls disc into locking position and retainer into shaft-end groove. Split nut can be turned in either direction to lift retainer and allow drum removal from stationary shaft.

A slotted drum facilitates change of accounting program, simplifies automatic control of carriage and calculator of an accounting machine. Variably shaped master plates establishing the work cycle can be rearranged or added without removing the drum. Reset time and skill required by a previous linear tabulator (DESIGN NEWS, February 1, 1957, pages 40-41) is reduced.

Master plates are inserted into radial slots in the drum and locked by the peripheral teeth of a face disc. No tools are required to release the drum and/or the master plates.

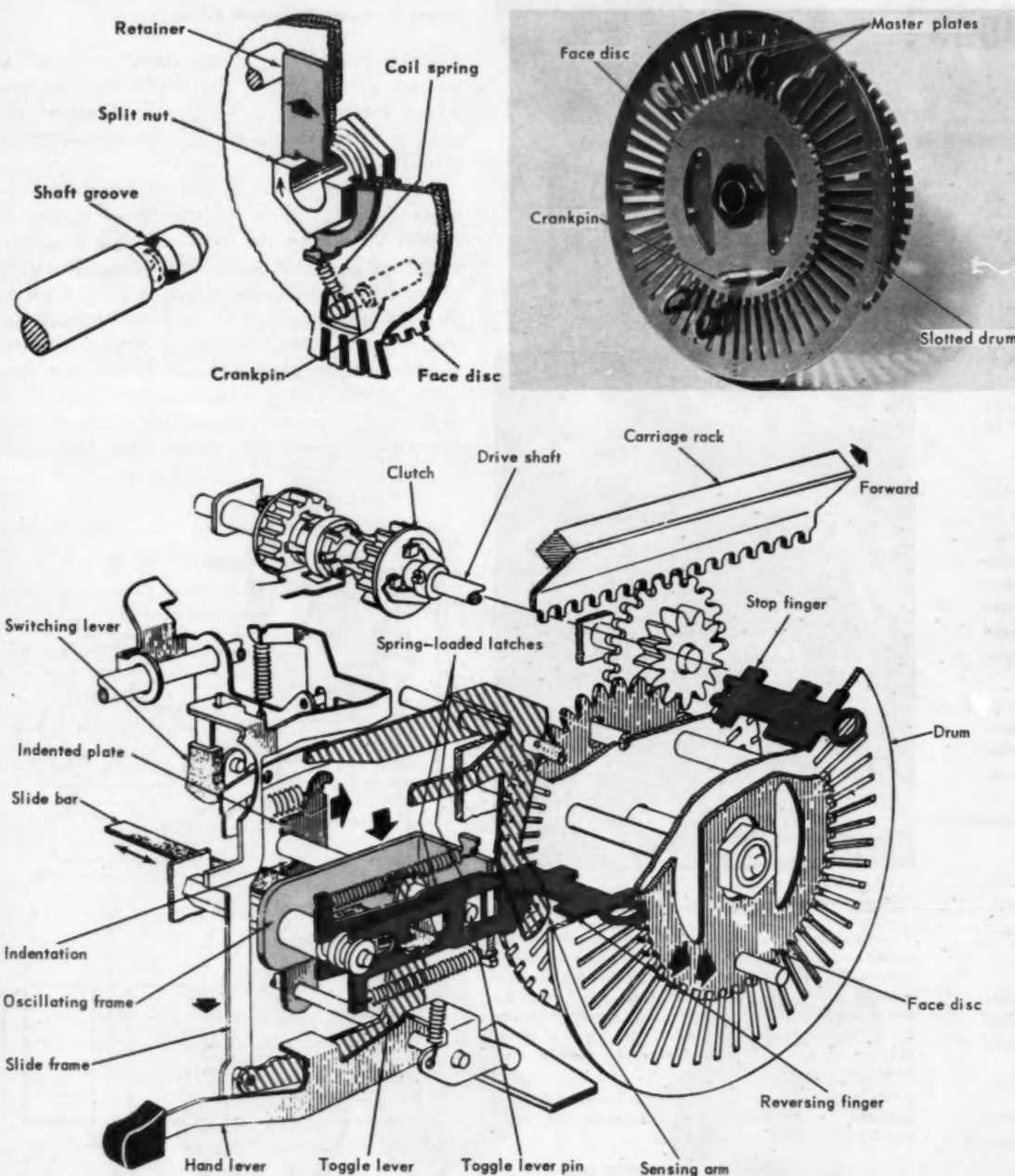


Spring-loaded latches on an oscillating frame catch on the advance and return stops of the master plates to stop the carriage at predetermined intervals. An indented plate forced by a spring against a lateral pin of the oscillating frame resists impact resulting from sudden carriage stop. The indentation allows limited frame swing to deaden impact force. Sensing fingers contacting various teeth of the master plates control calculator, carriage-reverse clutch and roller-actuating ratchet for automatic tabulation.

The machine is produced by Ing. C. Olivetti & Co. SpA, Ivrea, Italy.

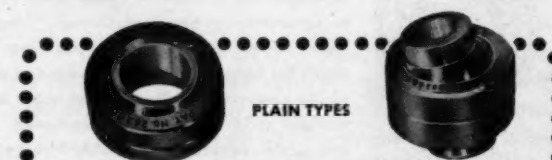
Circle 33 on Reader-Service Card for more information

Linear Tabulator to Ease Program Changes



ELECTRIC MOTOR drives carriage and drum through two-way clutch and gears. Staggered stop fingers on master plates limit and divide advance and return strokes of carriage into varying stops. Two spring-loaded latches engage, advance stops during forward carriage travel and return stops during backward travel. Reversing finger strikes sensing arm to set carriage reversing mechanism (not shown) in

motion. Slide bar, operated by reversing mechanism, holds back one latch and permits other latch to protrude into path of stop finger. At start of carriage travel in either direction, reversing mechanism moves slide frame down, causing toggle lever to pivot and pull engaged latch away from stop finger, freeing drum.



CHARACTERISTICS

ANALYSIS

- 1 Stainless Steel Ball and Race
- 2 Chrome Alloy Steel Ball and Race
- 3 Bronze Race and Chrome Steel Ball
- 4 "Dyflon"® Plastic Alloy Inserts, CRES Ball and Race, Chrome Alloy Steels.

RECOMMENDED USE

For types operating under high temperature (800-1200 degrees F.).

For types operating under high radial ultimate loads (3000-893,000 lbs.).

For types operating under normal loads with minimum friction requirements.

For types operating under rotational, high radial loads and long cycle life where lubrication is impossible.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Our engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. Write for Engineering Manual No. 551. Address Dept. DN-61

SOUTHWEST PRODUCTS CO.

1705 SO. MOUNTAIN AVE., MONROVIA, CALIFORNIA

Circle 34 on Reader-Service Card for more information

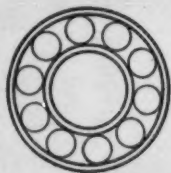
Reduce Bearing Space— Increase Bearing Life on heavily-loaded applications!

ORANGE *STAGGERED* ROLLER BEARINGS

with the unique STAGGERED ROLLER DESIGN

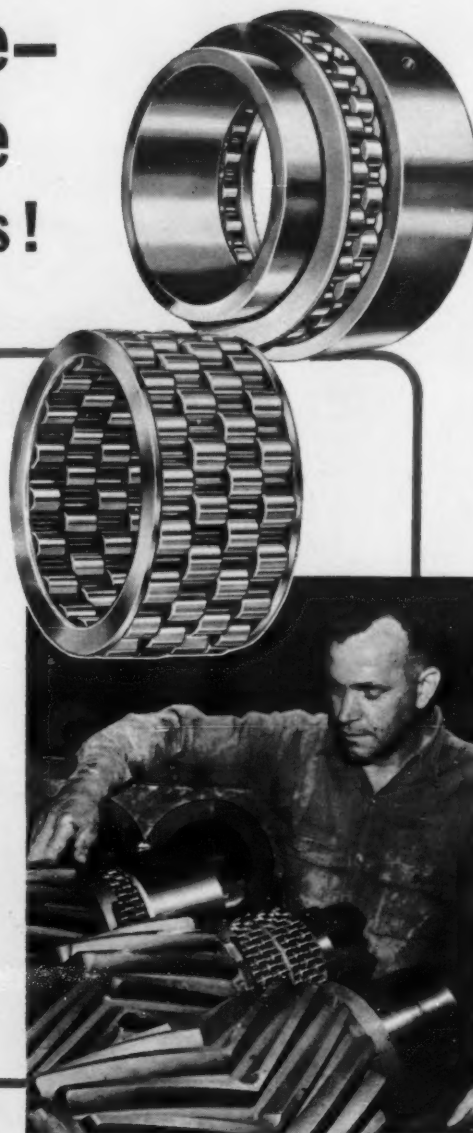


By using many short rollers in staggered arrangement instead of fewer long rollers as in conventional bearings, Orange "Staggered" Roller Bearings provide outstanding advantages for heavy-duty, highly-stressed and precision applications. They do the work of larger straight roller bearings—save space, weight and cost—assure long, trouble-free operation.



End views of "Staggered" roller bearing (top) and conventional bearing, show how many short rollers distribute the load over a multiplicity of contact points within the loaded zone.

- **Reduced Roller Skewing.** Short Orange rollers can skew only a fraction of longer rollers for a given angular misalignment. Short rollers align themselves independently, whereas longer rollers skew along their full length.
- **Better Fatigue Life** because short rollers greatly reduce damaging effects of edge loading, compared with long trunnion or cylindrical rollers, when dimensional deviations of parts or uneven loading are encountered.
- **Run More Smoothly** because closer centers of staggered rollers have half the chordal distance of conventional bearings. Especially valuable in printing, or rolling steel or foil.



"Staggered" Bearing ends trouble in Rod Mills

Converting to Orange "Staggered" Roller Bearings in the pinion stands of its rod mills, Washburn Wire Company, Phillipsdale, R. I. eliminated periodic bearing replacements and high lubrication costs. Operating 24 hours a day under tremendous loads, the "Staggered" bearings have remained maintenance-free for over 3 years. Washburn engineers say the change-over paid for itself in one year.

● Orange "Staggered" Roller Bearings are available in a complete range of sizes interchangeable with other bearings in the 200 and 300 series.

WRITE FOR ENGINEERING MANUAL M-59

ORANGE
ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
559 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers



Circle 35 on Reader-Service Card for more information

IDEAS...

MECHANICAL DEVICES

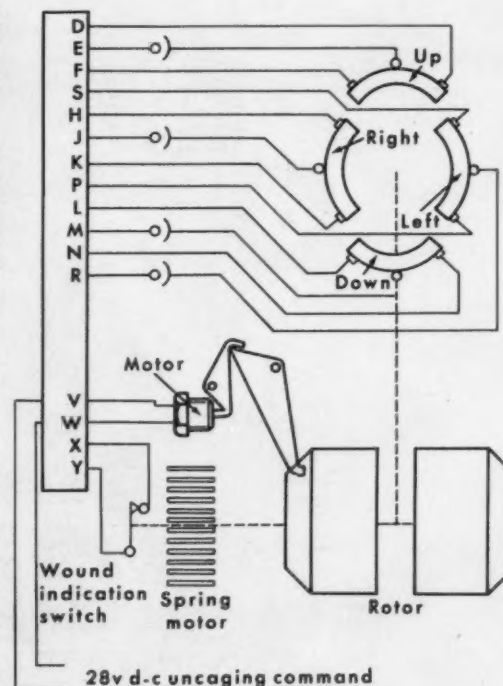
Spring Motor Drives

Robert L. Candlish, Detroit Editor

A coil spring serves as the drive motor of a low-cost gyro designed to provide inertial reference for missiles and other applications requiring a short-duration mechanically energized gyroscopic component.

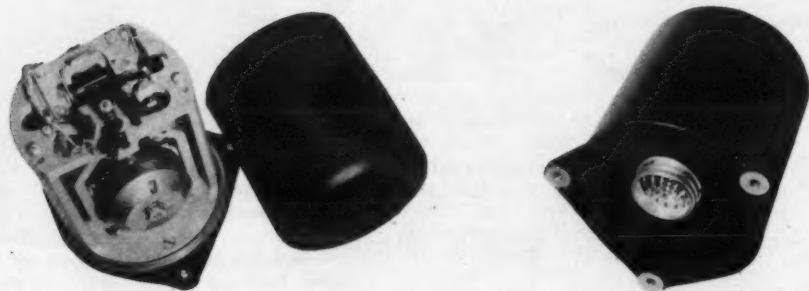
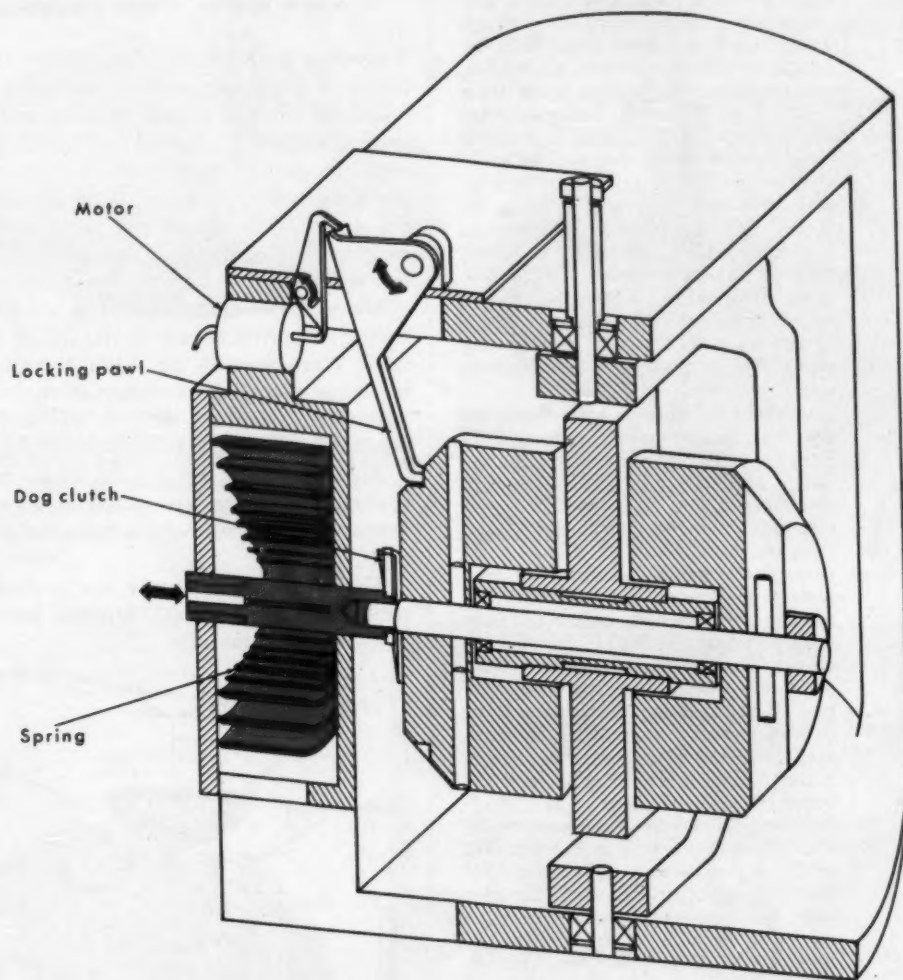
The spring motor in wound condition engages a dog clutch on the rotor shaft. Spring is slightly conical so the drive disengages axially as spring backs off when unwinding. Rotor is locked by 28v d-c motor-activated pawl. Unit is sealed hermetically. The instrument may be used repeatedly for a minimum of 25 times but must be unsealed and rewound before each use.

The Model 1091 spring-actuated gyro is a product of Courter Products Div. of Model Engineering & Mfg. Corp., Boyne City, Mich.



SEGMENTED PICKOFF COMMUTATORS on gyro outer gimbal provide roll reference information. Multi-contact connector provides connection to commutators and relays triggering current.

Ballistic Device Displacement Gyroscope



GYRO UNIT is 5 inches long by 4.2 inches in dia, weighs 3¼ lb. Full speed is attained in 100 millsec. Rundown time is 7 to 9 minutes. Maximum angular momentum is 737,000 gm cm²/sec. Drift after 30 sec is less than 1 deg for outer gimbals and 6 deg for inner gimbals. Both have 360-

deg freedom. Gyro rotor is brass; gimbal rings, base and housing are aluminum. Moment of inertia of gyro is 2116 gm cm². Rotor speed is 3330 rpm. High inertia of heavy rotor provides adequate sensitivity at relatively low speed.

10,000 P.S.I. SOLENOID VALVES



Important:
These valves are
standard catalog items.

- They are available for immediate delivery (in stock) at standard valve prices, for a service which generally requires costly (made-to-order) special valves.

- Shut off and 4-way valves in ¼, ⅜ and ½ inch port sizes are rated for 10,000 P.S.I. liquid or gases. They will withstand surges of up to 15,000 P.S.I. without damage to the valves' sealing qualities (designed for a burst pressure of 30,000 P.S.I.).

Solenoids are available for 115, 230 and 460 volt A.C. operation.

- Long maintenance-free service is achieved through the leak-proof "Shear-Seal" design. Optically flat metal to metal sealing surfaces (of the self-aligning sealing rings and the mating rotor face) are protected by staying in constant intimate contact: flow is always through the center of the "Shear-Seals," never across sealing surfaces. Sealing qualities actually improve as the seals lap themselves to a more perfect fit with each valve operation. There is no external shaft leakage because the pressure is confined to the flow passages.

For complete data write
for catalog S-10000.

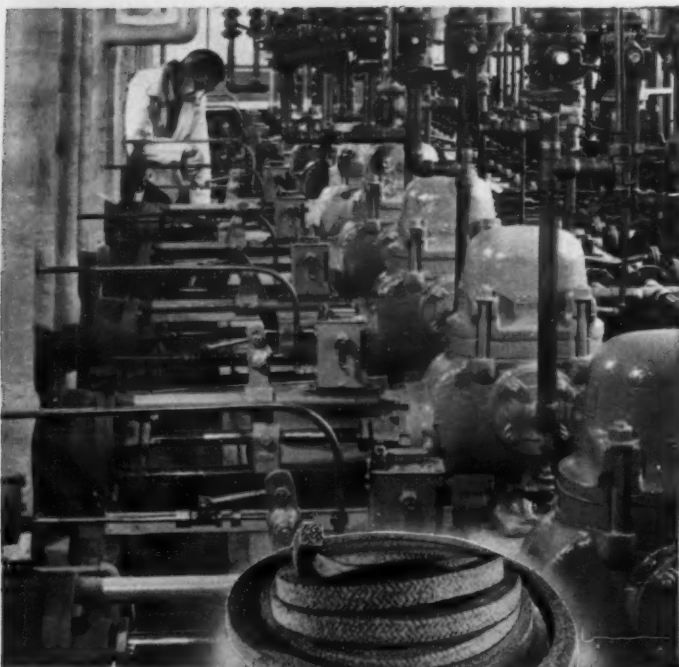


CONTROL VALVE DIVISION

Barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA
Circle 36 on Reader-Service Card for more information

ENGINEERED TEFLON PRODUCTS



Apply Garlock 5875 Teflon-impregnated Packing to centrifugal and rotary pump shafts, valve stems and expansion joints, and reciprocating rods, rams, and plungers... a premium packing at regular packing prices.

GARLOCK

NOW—YOU CAN BUY GARLOCK TEFLON* PUMP PACKING AT REGULAR PACKING PRICES!

Through an improved manufacturing technique, Garlock offers a Teflon-impregnated LATTICE BRAID† Packing at a reduction of approximately 40% over the price of similar competitive packing. Designated Garlock 5875, this packing can be purchased at prices comparable to regular packing.

Enjoy premium benefits without a premium price. Garlock 5875 offers a high Teflon content—more than 30% by actual weight—for greater protection, reduced wear. In temperatures from -90° F to +500° F, Teflon-impregnated LATTICE BRAID Packing is recommended for use against moderately destructive and corrosive mineral acids and caustics. For more destructive and corrosive applications, Garlock 5888 Teflon-treated fiber packing is recommended. Teflon, too, is as "frictionless" a material as you will find; this greatly reduces wear to the packing itself, and to any moving parts that it contacts during normal operation.

Specialized construction provides longer life, less maintenance. Garlock 5875 Packing is made from Teflon-impregnated white asbestos yarn, woven in the superior LATTICE BRAID construction. Here, each strand of treated yarn is intertwined at a 45° angle through the packing body. This completely integrates the structure for greater strength and, unlike ordinary square or round braid, eliminates individual layers of yarn—layers that, once worn through, destroy the usefulness of the packing. Without a layer or single outer braid to wear through, LATTICE BRAID remains unified without disintegrating far beyond the limits of other packings.

Enjoy fast delivery from warehouse stock. Garlock 5875 Packing is immediately available in sizes from 1/4" through 5/8" in either spool or reel form to meet your specific needs; also available on order in ring form in these sizes. Specify now from your local Garlock representative at the nearest of the 26

Garlock sales offices and warehouses throughout the U.S. and Canada. Or, for more information, write for Catalog AD-185, Garlock Inc., Palmyra, New York.

Canadian Div.: Garlock of Canada Ltd.
Plastics Div.: United States Gasket Company

Order from the Garlock 2,000... two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

*DuPont Trademark for TFE Fluorocarbon Resin

†Registered Trademark

IDEAS...

MECHANICAL DEVICES

Worktable Swings Around

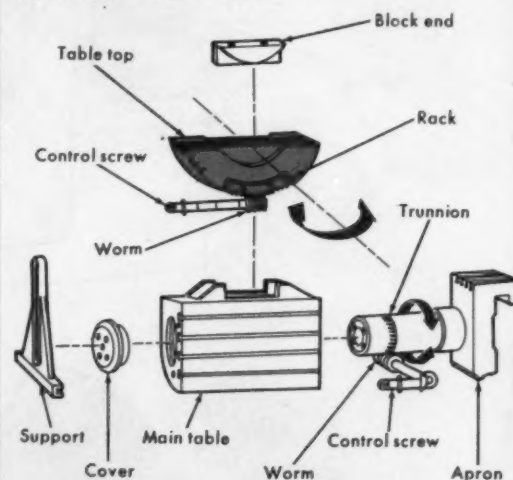
Volrath Holmboe, Swedish Correspondent

A separate, semi-cylindrical top permits transverse tilting of a shaping machine worktable. Tilting is guided along a groove between seats in the main table and two curved end blocks. Together with the main table, which is fully rotatable about a large diameter trunnion, the semi-cylindrical top forms a universal table with a wide range of compound angular set-ups. Angular control is by simple worm gear transmissions.

Added suspension possibilities are gained by having a finished surface on the side of the main table. When vertical, this side is suitable for fixing large pieces of complicated shapes. When horizontal, it is flush with the top of the apron together with which it forms a conventional table.

Tool lifting on the return stroke is accomplished by a friction lever riding on a fixed track. It is of particular value when using carbide-tipped tools.

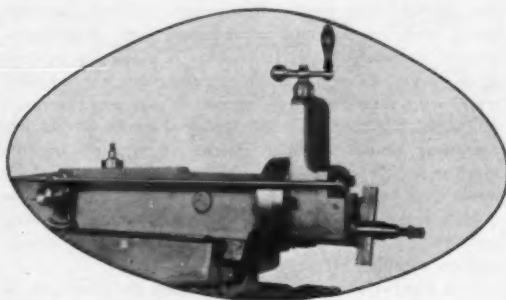
The ES Universal Shaper is a product of Värnamo Maskinaktiebolag, Värnamo, Sweden, and is made in various sizes.



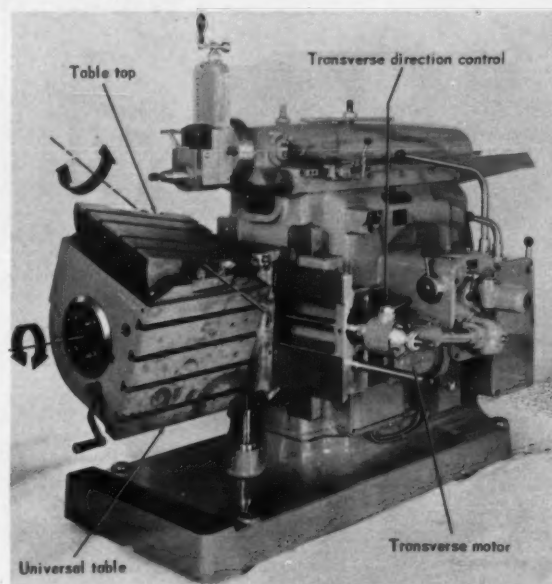
ANGULAR SETTING of universal table is controlled through worm gears by hand-crank-operated screws at front. Curved tooth rack on semi-cylindrical table top serves as worm gear for transverse tilting. Large-diameter trunnion functions as worm gear for rotation of main table. Table top can be tilted ± 15 deg and main table 360 deg. Two fixing bolts on each of curved end-blocks clamp top, and four bolts in front clamp main table to trunnion. Removable table support slides on finished rail on machine base and is attached to trunnion by single bolt so that rotation of table is not prevented. Trunnion is cast integral with apron.

Circle 37 on Reader-Service Card for more information

Two Axes, Permits Skew-Line Shaping



TOOL-LIFT DEVICE consists of friction lever which is connected to hinged support of cutting tool. Friction lever slides with circular segment covered by 5-mm thick foam rubber in contact with horizontal rail. Friction is adjusted by rotating eccentric sleeve in bearing of friction lever. On return stroke friction tilts lever so that tool is lifted from workpiece.



MICRO-STRESS INSTRUMENTATION

Orders of Magnitude More Sensitive SEMICONDUCTOR STRAIN GAGE MICRO-SENSOR MS 105-350

For Application to: Structural Members • Transducer Sensors

FEATURING

- Sensitivity—gage factor 130
- Easily bonded to all types of surfaces for military, industrial, and space applications
- Integral terminal construction
- Superior signal-to-noise ratio
- Resistance—350
- Size: Element— $\frac{1}{8}$ " x .020" Complete Gage—1" x $\frac{1}{2}$ "
- Radius of Curvature— $\frac{1}{4}$ "
- Maximum Operating Strain—over 3000 microstrain

IMMEDIATELY AVAILABLE—

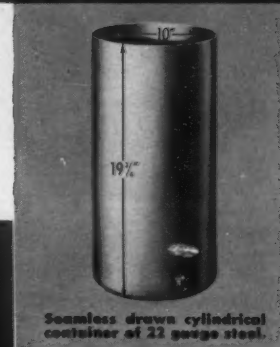
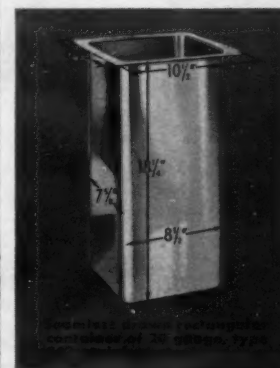
ADDITIONAL INFORMATION ON REQUEST

MS
MICRO SYSTEMS INCORPORATED
480 Agostino Rd., San Gabriel, California
A Subsidiary of Electro-Optical Systems Inc.

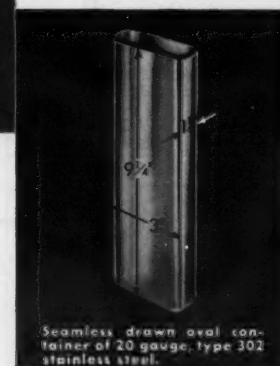
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DESIGN NEWS—FEBRUARY 13, 1961

No Tooling Cost
To Draw Shapes
Like These
and dozens of others
with **POLAR WARE**
Facilities



Seamless drawn cylindrical container of 22 gauge steel.



Seamless drawn oval container of 20 gauge, type 302 stainless steel.

It will pay you to check out your new design ideas with Polar Ware. The chances are good that our hundreds of existing dies, plus the facilities of our complete tool and die shop, can save you thousands of dollars in tool cost, plus weeks of waiting time. Difficult seamless deep drawing work in stainless steel is our specialty, in gauges from 3 to 30; also carbon steel and aluminum. Take advantage of our more than 50 years' experience in metalworking. Without obligation, send your inquiry to the Contract Department.



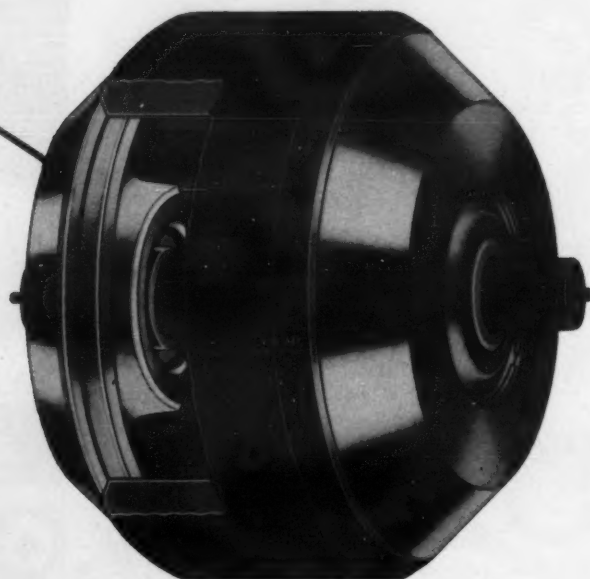
Polar Ware Co.

4200 Lake Shore Road—Sheboygan, Wisconsin

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39

BARDEN end-bell bearings
boost miniature gyro performance –
reduce assembly time and cost



Integral design simplifies manufacture, reduces mating-part errors



Z155, above and in main illustration, is one of several Barden Precision end-bell bearings currently in volume production. Bore sizes range from .0781" to .1250" for through-bored rotor rings from .5751" to .9375" I.D. For complete technical information, write for Engineering Data Sheet Z-1.

Rotor bearings for miniature rate gyros in missile stabilizing systems must meet extremely high performance requirements, yet allow economical production and assembly. To solve this problem, Barden pioneered special configuration, high precision end-bell bearings.

Pressed into opposite sides of the through-bored rim, these bearings become an integral part of the gyro spin mass while serving as end caps for the gyro wheel assembly. This eliminates delicate fitting of very small bearings into conventional end bells... reduces mating-part errors and assembly time... improves squareness, concentricity, and overall accuracy and reliability.

One gyro manufacturer reports that the use of Barden Precision end-bell bearings in place of conventional flanged bearings reduced noise levels 50% and made it possible to meet unusually stringent life requirements.

Like other Barden advances in design and production, end-bell bearings solve a specific performance problem. Other Barden Precision bearings satisfy such extreme demands as:

- High temperatures (to 575°F)
- Low torque (to 10 dyne-cm. for 2 lb. load)
- High speeds (to over 300,000 RPM)
- Concentric rotation (to .00005" max. T.I.R.)

Barden is a major supplier of standard bearings in sizes from .0469" bore to over 3" O.D., all manufactured to Barden Precision standards of dimensional accuracy, uniformity and reliability. See Sweet's Product Design File (8h/Ba) for Barden catalog and bearing selection guide.

IDEA MART

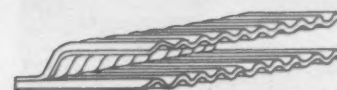
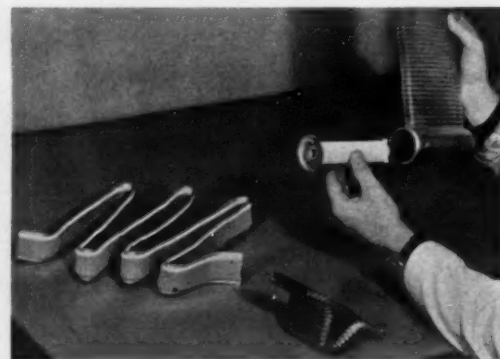
AVAILABLE

Heat Exchanger

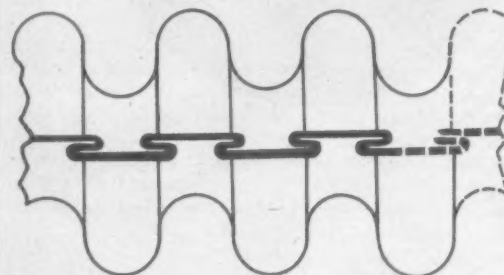
This new "accordion" heat exchanger combines excellent recovery with negligible exterior "blockage" as compared with conventional extended-fin heat exchangers. Its cost in material and fabrication is a fraction of that of the latter. Extremely high transfer rates are achieved (even with stainless steel) because of the great surface-to-length ratio and the high degree of turbulence of the contained heated medium which are realized in this novel design. The heat exchanger may even be bent back upon itself without restricting the inner passage. This quality makes the attachment of return fittings unnecessary, consequently reducing the cost of the final configuration considerably.

This lightweight heat exchanger may be produced in indefinite length by a continuous forming process using metal strip stock of virtually any kind. The edges are joined securely by an interlocked and collapsed "dove-tail" which may be easily seam-welded afterwards if a high-pressure seal is required. The finished heat exchanger may be supplied in bulk coils of several hundred feet.

The developer of this heat exchanger is interested in finding responsible companies to manufacture it under license. United States and foreign patents are pending. Write C-45, Idea Mart, Design News, 20 N. Wacker Dr., Chicago 6, Ill.



Heat exchanger with one flat side



Detail of collapsed interlocking dovetail joint

for reliability... specify

BARDEN



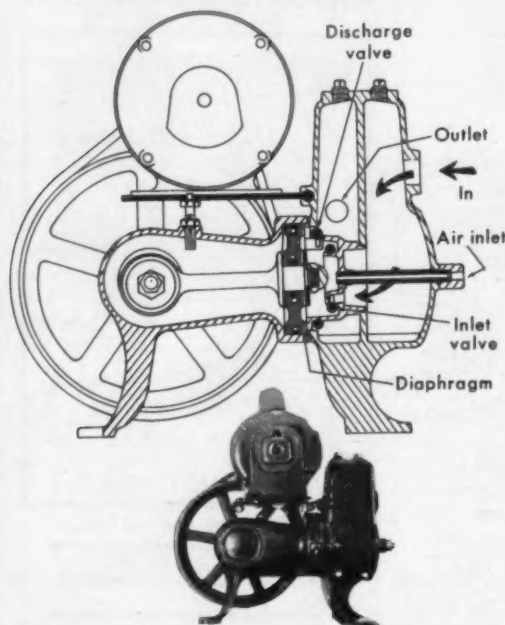
PRECISION BALL BEARINGS

THE BARDEN CORPORATION, 230 Park Avenue, Danbury, Connecticut
Western Office: 3850 Wilshire Boulevard, Los Angeles 5, California

Circle 40 on Reader-Service Card for more information

AVAILABLE

Horizontal Diaphragm Pump



The diaphragm pump has no packing gland, no leakage and no loss of prime due to leakage and air intake.

One of these pumps, on a continuous test, has operated the equivalent of over 10 years pumping a mixture of sand and water with only slight wear being visible. Actual use in the field has indicated a maximum diaphragm life of about 10 years or more operating under normal use and conditions.

The diaphragm is the heart of this pump and was developed after many years of developing and testing various types. The diaphragm illustrated has a thick center and outer periphery with hollow-like grooves between to form a flexing area. The central ID has a groove to receive a metal washer through which a connecting rod is attached. This assembly provides the diaphragm with an annular air pocket which acts as a shock absorber on the pumping stroke and permits flexing of the diaphragm without undue strain. The face of the periphery of the diaphragm also has an annular groove into which is fitted a metal ring and serves also as a shock absorber and lessens the flexing strain on the diaphragm.

A third important means of adding flexibility and long life to the diaphragm is its installation in a cylinder smaller than the diaphragm. Adding radial compression to the diaphragm crowds the fibers of the rubber together to prevent undue strain and to add flexibility of a 70 durometer, hard molded rubber or Neoprene diaphragm. Thus, structurally shaping the diaphragm assures more positive sealing at the connecting rod and between the periphery of the diaphragm and housing aided by sealing rings and provides a maximum of flexibility intermediate the seals where flexibility is needed.

The valves are operated by alternate suction and compression conditions within the pumping chamber without the aid of springs or other mechanical parts. The unit is especially more efficient and quieter when the improved O-ring roll-up type valve is used. Write J. O. M., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.

NOW—another FIRST by the Originator of Eddy-Current Equipment

NEW DYNAMATIC Model 905 Ajusto-Spede® Drive



Red tint indicates
output member

Extends Capacity Range to 15 HP in the Popular Quill-Type Design

The addition of the new model ACM-905 to the famous ACM-903 and ACM-904 lines of Dynamatic Ajusto-Spede Drives makes the desirable features of Dynamatic Quill-Type design available for many new applications.

Dynamatic Ajusto-Spede Drives provide controlled adjustable speed from an AC power source. Standard control features include on-off clutch control, infinite speed adjustment, constant speed regulation, and jogging. Any of a variety of special features may be easily and economically added to the standard control.

All Quill-Type models are available with either eddy-current, Dyna-torQ, or fail-safe brakes.

An Ajusto-Spede Drive, a control unit (either electron tube or transistorized magnetic amplifier), and a push-button station comprise a compact, easily installed, low-cost drive package.

Check these Ajusto-Spede® Advantages

- ★ Infinitely adjustable speed from AC power
- ★ Simplified construction
- ★ Compact design
- ★ Wide speed range
- ★ Remote control
- ★ Stationary field coils
- ★ Excellent performance characteristics

Send for Illustrated Descriptive Literature



EATON

DYNAMATIC DIVISION
MANUFACTURING COMPANY
3122 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

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ROPER PUMPS

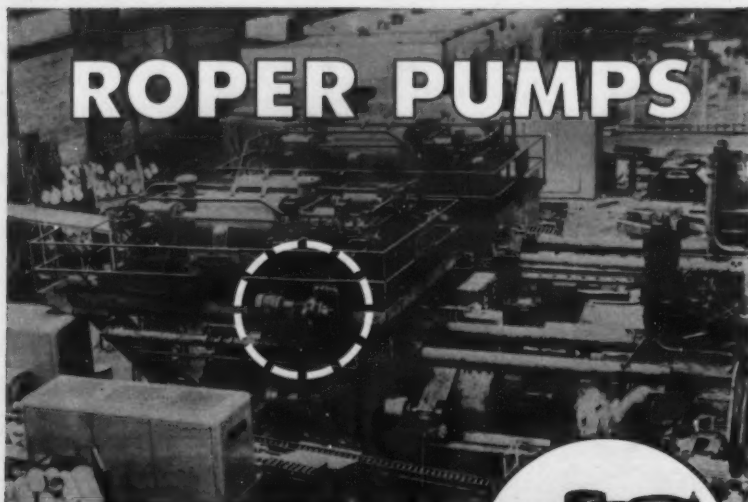


Photo courtesy of the designer-builder of the hydraulic presses

SERIES F Model 2F75 Spec. 35

**pre-fill pump
brings aluminum
extrusion press hydraulic
system to operating pressure**

1-300 GPM CAPACITIES • OPERATING PRESSURES TO 300 PSI

The hydraulic system of this self-contained oil hydraulic four column aluminum extrusion press, designed and built by Birdsboro Corporation, relies on a Roper Series F pre-fill pump to fill the hydraulic cylinder with oil to operating pressure. The Roper pump was installed as original equipment when the press went into operation five years ago. The 200 SSU viscosity oil is pumped at the rate of 84 gpm and pressure of 125 psi as pump operates at 1140 rpm. Series F pumps are specially designed for transfer of clean liquids in applications such as hydraulic power pressure lubrication or fuel oil transfer. Pump has arrangement for circulation of oil through bearings to control their operating temperature.

INSIDE STORY OF SERIES F

- **PUMPING GEARS:** pair of six-toothed helical gears of heat-treated steel, accurately finished to keep pump running smoothly, quietly.
- **BEARINGS:** two bronze, flange-type bearings on each side give ample support to pumping elements which are self-cooled and lubricated by liquid being pumped.
- **BACKPLATE:** carries pipe connections, designed to permit removal of internal parts without disturbing piping or drive.

*For information about your specific pump needs,
contact your nearest Roper dealer*

Send for "How to Solve Pumping Problems" booklet

**ROPER
HYDRAULICS, INC.**

**Dependable pumps
since 1857**

COMMERCE, GEORGIA

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IDEA MART...

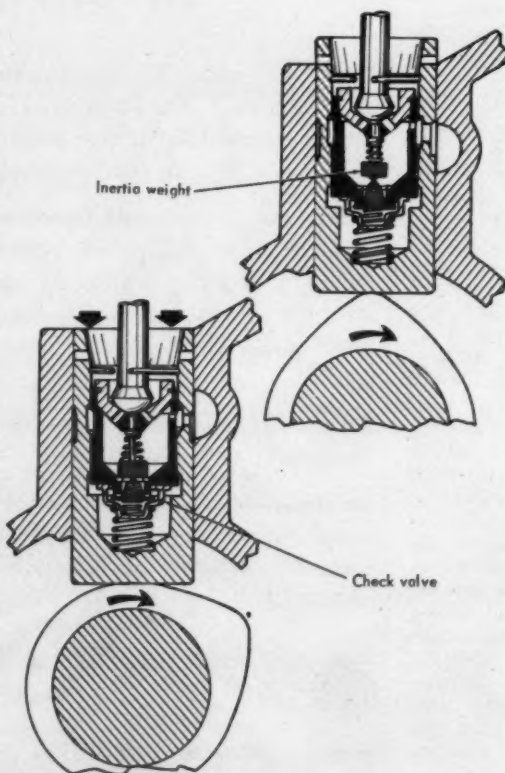
AVAILABLE

Self-Adjusting Hydraulic Valve Tappet

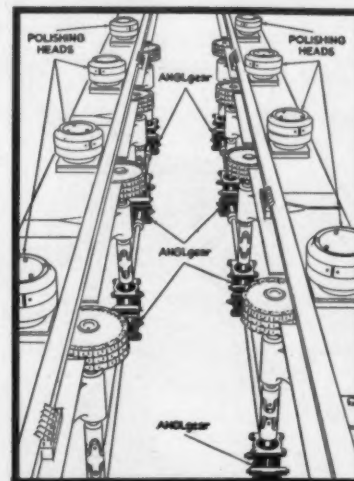
This self-adjusting tappet features a novel and improved inertial-controlled check valve which functions automatically in response to tappet motion. It insures positive opening of the compensating port between the high-pressure chamber and reservoir during the tappet cycle.

The inertial weight is supplemented by a normally preloaded spring additionally energized during the upward throw of the weight to subsequently react there against during its downward throw to insure the check valve opens upon tappet contact with the base circle of the engine-operated cam.

The check valve and inertial weight are counterbalanced substantially by a spring to provide delayed closing of the compensating port for maximum interval of relative adjustment between the tappet body members to remove any backlash from the valve drive gear. This latter spring is rated to enable the check valve to lightly seat and firmly close the compensating port from pressure chamber. This prevents fluid transfer from chamber to the reservoir so that the adjusted status of the body members cannot change as the lifting phase of the tappet cycle begins. This produces quiet engine-valve operation. Write G. T. R., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



ANGLgear® solves multiple indexing problem



Eight standard model R-350 3-way ANGLgear units are driven by a single motor to transmit power at 90° to indexing heads directly above them and rotate those heads at a constant 60 rpm.

Eight indexing rotors must revolve at exactly the same speed to accurately position polishing heads on bumper polishing machines made by the Murray Way Corporation of Birmingham, Mich. ANGLgear makes sure that the positioning process takes place with complete synchronization and reliability—its superior construction minimizes backlash and free motion.

Other ANGLgear features that particularly appealed to the designer were low-cost solution to the design problem, efficiency, compact design, ease of installation through ANGLgear's universal mounting feature, and sealed-for-life lubrication.

ANGLgear can help simplify design problems and reduce costs wherever 90° power take-off or constant speed is involved.*

You can specify ANGLgear in 1/4, 1, 2 1/4 and 5 hp ratings with 1:1 or 2:1 gearing and 2- or 3-way shafting.

Send for Catalog IA-58 or contact our local distributor.

*Design templates free on request.



AIRBORNE
Engineered Equipment for Aircraft and Industry
AIRBORNE ACCESSORIES CORPORATION
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Circle 43 on Reader-Service Card

DESIGN NEWS—FEBRUARY 13, 1961

NEW!



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EASILY READ 4 1/2" INDICATOR Damped to withstand vibration and shock.

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\$87.00 includes generator, indicator (specify range), mounting base, coupling, and 15 ft. of electrical cable. Delivery from stock. Quantity discounts.



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AVAILABLE

Flux Diverter

This invention relates to means for directing the flux in a magnetic circuit to redistribute itself in parallel paths and, in particular, to a novel arrangement for diverting leakage flux from across a gap between adjacent poles of a magnetic recording-reproducing head.

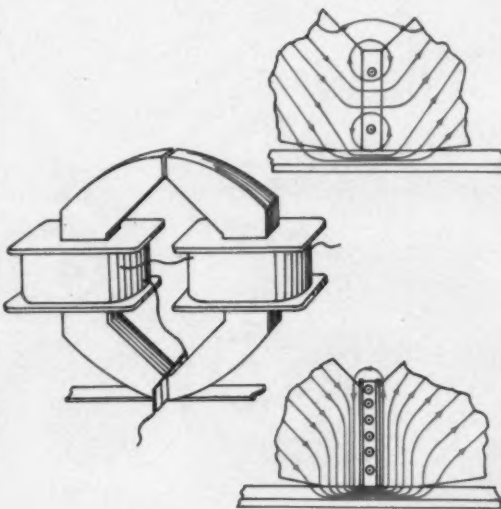
Present ring-type recording-reproducing heads are provided with a nonmagnetic metallic shim usually 0.0004-0.0005 inch thick separating the poles. Such a shim enables a considerable leakage flux to pass without entering the magnetic recording medium, causing the flux to arrive at the pole tips with an unfavorable slant and reduced density.

An object of this invention is to divert the leakage flux across the gap of a ring-type recording head into the recording medium.

A further object is to cause the flux entering a recording medium to enter more nearly perpendicular than with ordinary longitudinal recording by establishing a field adjacent to the gap shim which is perpendicular to the recording medium.

A further object is to increase the flux density at the adjacent pole tips and increase the penetration of the flux into the medium when recording and so provide a stronger signal, reduce the tendency of self-demagnetization of the recorded signal and enable the recording medium to take a higher frequency at a lower speed for a given output level than was practiced previously.

In accordance with this invention, an electromagnetic coil or shim is inserted on a parallel flux path and so arranged and electrically connected to expel external flux therefrom according to the current. It has been determined experimentally that the combined flux from two aiding paths in a third can be greater than the sum of the flux from each aiding path separately contributing, since the path not contributing provides a leakage path for the flux from the path contributing as illustrated. This means that the leakage flux is diverted from the noncontributing path when that path is made to contribute a sufficiently large opposing flux, and the third path then carries the total of both paths instead of that contributed by the first minus leakage through a noncontributing path. Write L. D. B., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



NOW! ELIMINATE SPEED REDUCTION COST



Patent No. 2,821,171

Char-Lynn HYDRAULIC ORBIT MOTORS

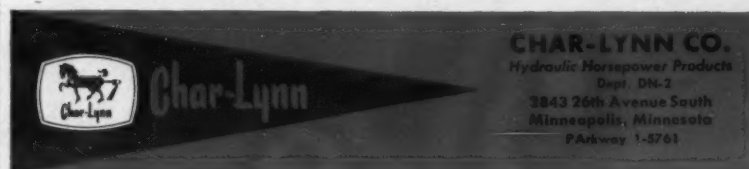
Deliver HIGH TORQUE at LOW SPEED

Now you can eliminate costly and cumbersome *Speed Reducers* — Save valuable working space — Increase efficiency — Reduce Maintenance costs with CHAR-LYNN ORBIT MOTORS.

These Motors offer you a new concept in fluid power mechanics and provide a practical and economical solution to the problem of providing HIGH TORQUE — at LOW SPEEDS for Constant and Variable speed drives — Hydrostatic Transmissions and Remote Controls.

- SPEEDS from 10 to 800 R.P.M.
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- Standard mountings available

FOR DETAILS ON THESE HIGH TORQUE... LOW SPEED Motors write to:



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Bearing at left has 1.75" bore, while tandem bearing in main illustration has 17.0" bore. Yet both are standard, cataloged items.

Over 400 Cataloged Thrust Bearings to fit your every need...

When you need a thrust bearing, no matter how special, Rollway is ready with the know-how and the precision machinery to design and produce it for you.

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PATENTS

Four-Way Valve

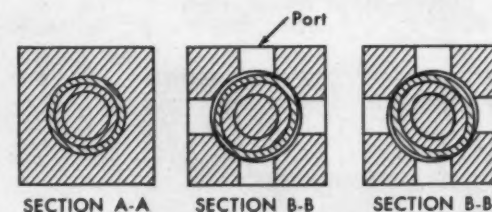
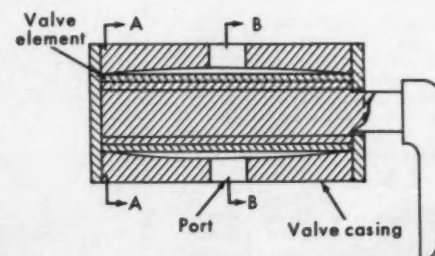
U. S. Patent 2,961,006; C. Walton Musser, assignor to United Shoe Machinery Corp., Flemington, N. J.

This four-way valve provides hermetic sealing and essentially rolling rather than sliding engagement. A flexible valve is deformed into engagement with interior of casing at appropriately spaced points to selectively seal and isolate desired valve ports one from another, while connecting other ports.

The valve casing has an internal bore of circular cross-section which progressively increases in diameter from the ends toward the middle. Radial ports equally spaced around the circumference are formed at the middle of the casing. Extending longitudinally within the casing is a flexible tubular valve element which is initially of circular contour and conforms at the ends of the interior of the casing.

Inside the valve element is a wave generator which is elliptoidal in cross-section at the middle and circular in cross-section at the ends and engages the interior of the valve element. Thus, at the middle there are two points of sealing. Sealing pressure is determined by the force exerted by the wave generator.

The elliptoidal contour referred to is described by the condition that is created by two sine waves superimposed on a circle in 360 deg, with the crossing points (points of zero deflection) displaced 90 deg. Maximum displacement from the circle at the high points equals the minimum displacement of the troughs of the wave. This configuration assures adequate sealing at each lobe.

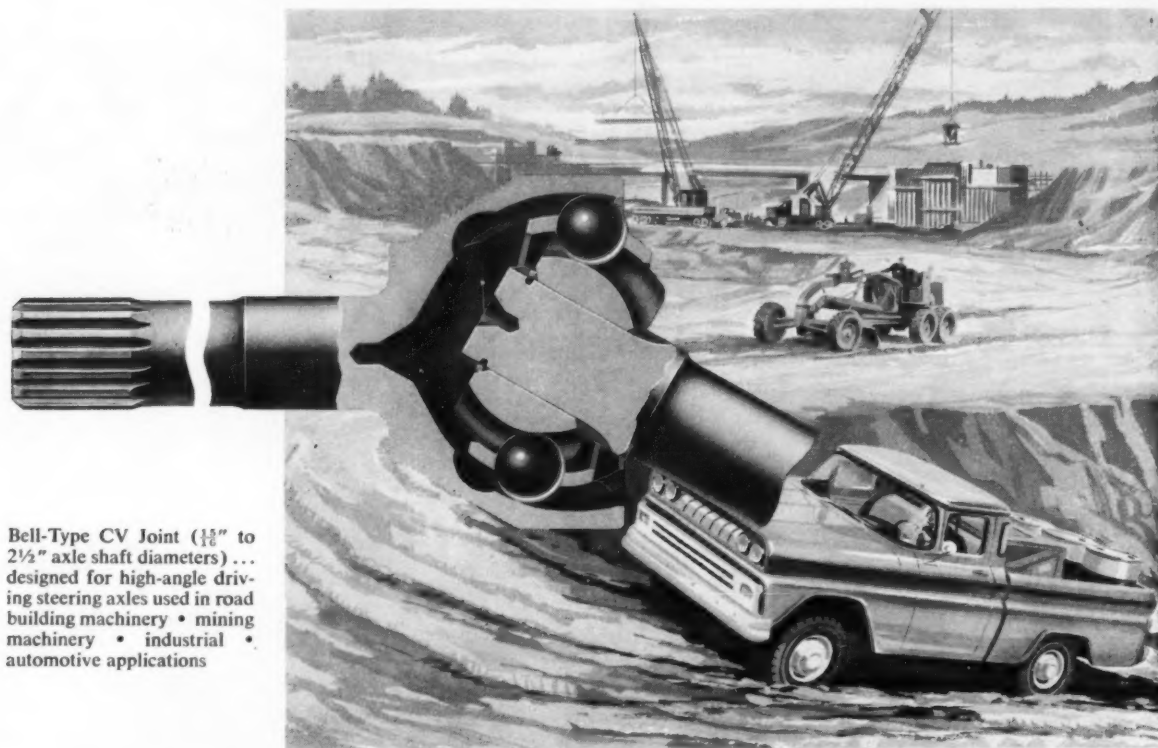


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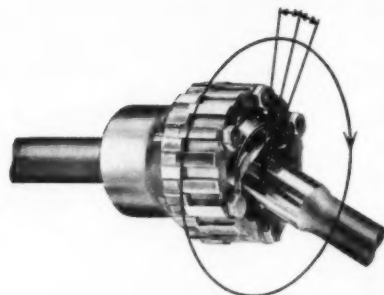
designed, tested and ready for production with load capacities to 4,800,000 pounds.

Ask for Catalog PT-659.

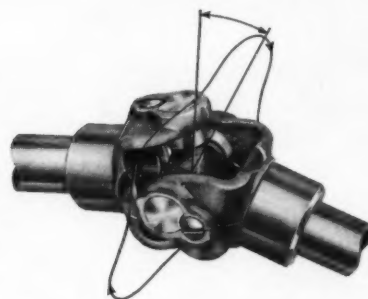
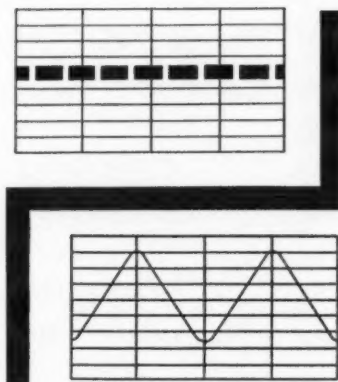
CON-VEL (RZEPPA) CV Universal Joints Give Longer Life, Higher Torque Capacity!



Bell-Type CV Joint ($\frac{1}{8}$ " to $2\frac{1}{2}$ " axle shaft diameters) ... designed for high-angle driving steering axles used in road building machinery • mining machinery • industrial • automotive applications



Disc-Type CV Joint (from $2\frac{1}{8}$ " to $16\frac{1}{4}$ " swing diameter) ... designed for all types of industrial drive applications. Rzeppa Joints always transmit torque smoothly, even at unbalanced angles. Note constant velocity of 100% for Rzeppa Joint.



During rotation at a given angle, pin or slipper-type joints speed up, slow down twice during one revolution, as shown by the solid line in the graph.



CON-VEL DIVISION

DANA CORPORATION

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for your free copy of this new engineering data folder on the complete line of Rzeppa constant velocity joints.



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Tool and Hardware Manufacturers Use Malleable for the Parts They Guarantee...

"Guaranteed Against Warping or Breaking" is the seal of quality often found on tools and hardware made of Malleable iron. Frequently Malleable components are guaranteed while the other materials in the same tools are not.

Proven performance superiority has induced many tool and hardware manufacturers to switch to Malleable castings so they, too, can guarantee their products. At the same time, they often reduce their costs. How? Because Malleable provides more strength per dollar than any other metal; Malleable is the most machinable of all ferrous metals of similar properties; Malleable is truly outstanding for its toughness, ductility, castability and corrosion resistance. While Malleable's natural appearance is attractive, a wide variety of finishes can be applied for added customer appeal.

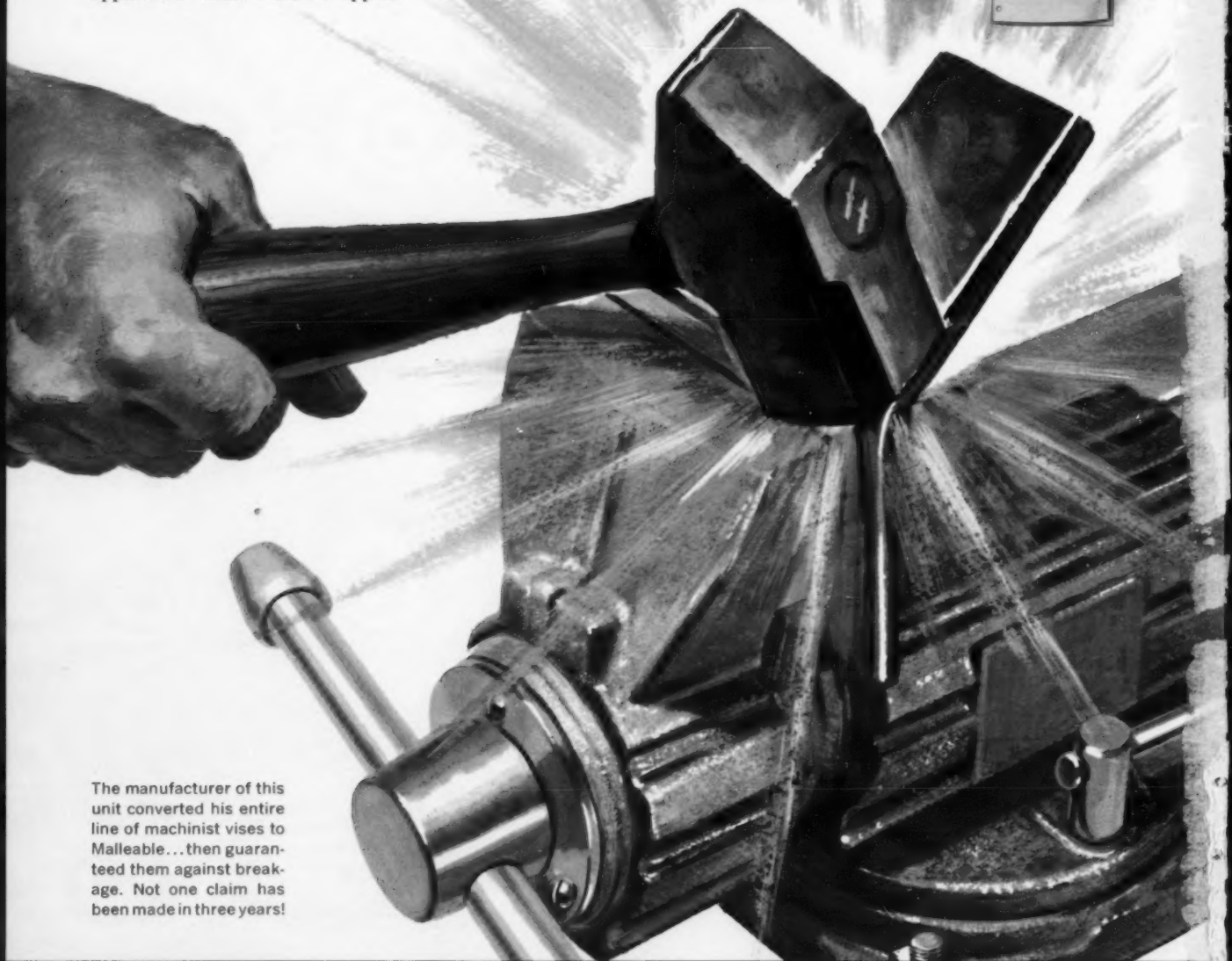
Improve your products by using Malleable castings. Check with any Malleable producer that displays this symbol —



Profitmaking Ideas are yours free in our Data Unit No. 114, available from any member foundry, or Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.



The manufacturer of this unit converted his entire line of machinist vises to Malleable... then guaranteed them against breakage. Not one claim has been made in three years!



\$10,000 per year are saved by the manufacturer of this hydraulic jack since he converted the 16 inch long caster bar to a Malleable casting. The bar originally was a fabricated part that required shearing, punching, sawing, chipping, grinding and reaming, plus welding at eight points. The Malleable casting is delivered ready-to-use at a savings of \$2.68 per unit.



The wide range of Malleable's properties permits its use in hundreds of tool and hardware applications. Besides the examples shown here, Malleable is used for load binders, chain hoists, hinges, many kinds of clamps, pliers, trailer hitches, jack screws, gun frames, fence fittings, casters, brackets and pipe threading and cutting tools.

When you're interested in high quality and long life, Malleable gives your products many competitive advantages. We'll be glad to show you how. Write or call one of the companies listed below.



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DELAWARE

Eastern Malleable Iron Co., Wilmington 99

ILLINOIS

Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mail and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA

Albion Malleable Iron Company,
Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
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Becher Malleable Iron Co., Easton

MICHIGAN

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Auto Specialties Mfg. Co., Saint Joseph
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MINNESOTA

Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI

Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE

Laconia Malleable Iron Co., Laconia

NEW YORK

Acme Steel & Mail. Iron Works, Buffalo 7
Fraser & Jones Company Division
Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mail. Iron Co., Westmoreland

OHIO

American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mail. Iron Co., Ironton Div., Ironton

Dayton Mail. Iron Co., Ohio Mail. Div., Columbus 16
National Mail. and Steel Castings Co., Cleveland 6

PENNSYLVANIA

Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

TEXAS

Texas Foundries, Inc., Lufkin

WEST VIRGINIA

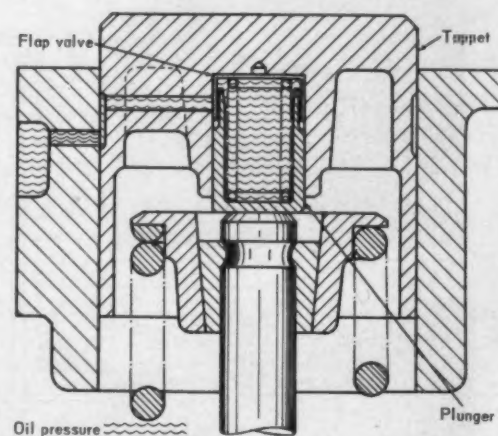
West Virginia Mail. Iron Co., Point Pleasant

WISCONSIN

Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

Self-Adjusting Tappet

British Patent 831,984; Cormac G. O'Neill, Engineering Research and Application, Ltd., London Road, Dunstable, Bedfordshire, England.



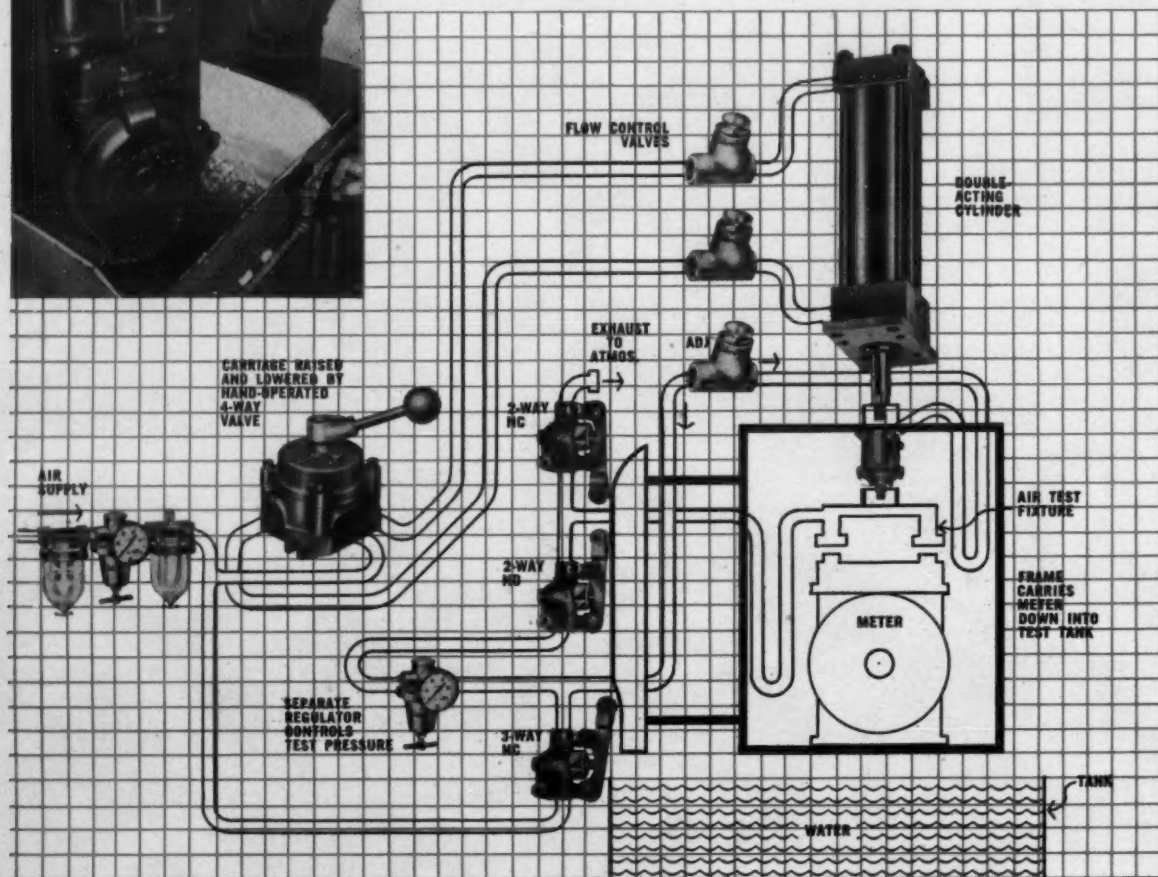
This "inverted pot"-type tapped mechanism uses a slotted nylon flap valve to admit engine pressure oil to a plunger chamber for automatically taking up wear. An advantage over the non-return ball valves usually associated with hydraulic tappet adjusters is that dirt and air in the system do not impair its efficiency to the same degree. Machining and assembly are facilitated. Shims are not necessary for adjustment.

A cylindrical plunger fitted in the inverted pot bore is maintained in contact with the valve stem end by a light spring. During the engine valve opening period, the plunger carries the valve compression spring load and all valve mass inertia loadings. By relieving metal from the plunger open end a cylindrical cavity is formed adjacent to the bore upper end. The nylon valve length is two-thirds the plunger relieved portion length, permitting communication between the cylindrical cavity and the inverted pot bore wall.

In operation, pressure oil fed through a radial channel opens the nylon flap valve and flows into the cavity and the chamber inside the plunger. Camshaft rotation then brings a cam against the inverted pot, moving it down to compress the plunger spring and the oil which closes the nylon flap. The force exerted by the pressurized oil moves the plunger down to open the engine valve. As the cam non-lifting position is reached, a small oil loss occurs from the plunger chamber where a slight vacuum is created by the light spring. Oil supply pressure to the tappet then exceeds pressure in the plunger chamber. The flap reopens to replace the lost oil and take up the tappet clearance.



Here's how one company tests its products with air. This air circuit of Schrader Products at the Sprague Meter Company in Bridgeport, Connecticut, automatically clamps meter ports airtight, lowers meter into water, and fills it to test pressure. Operator looks for tell-tale bubbles from leaks, then presses lever to raise meter automatically. Says the Plant Manager: "This used to be a slow, arduous process. Now a meter's in the water, under pressure, in less than a second."



MANUFACTURER SETS UP CRITICAL TEST IN LESS THAN ONE SECOND—WITH SCHRADER AIR PRODUCTS

As products grow more complex and precise, many manufacturers are *simplifying* their operations—with air cylinders, valves, fittings and simple schematic planning. They're installing their own circuits, as this manufacturer did, or letting Schrader experts help. For example, Schrader Air Products can inspect, test, assemble, package—do work faster, more accurately—save effort and money.

Never forget air can make almost any motion human

hands can—push, pull, hold, position, or move repetitively. And air doesn't get tired—has more powerful muscles. Maintenance? Almost nil.

Take full advantage of your air power by automating with Schrader—the most complete line of Air Cylinders, Valves, and Accessories. Schrader engineers have experience and know how to help you cut your operating costs.

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QUALITY AIR CONTROL PRODUCTS

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PATENTS...

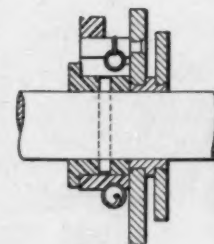
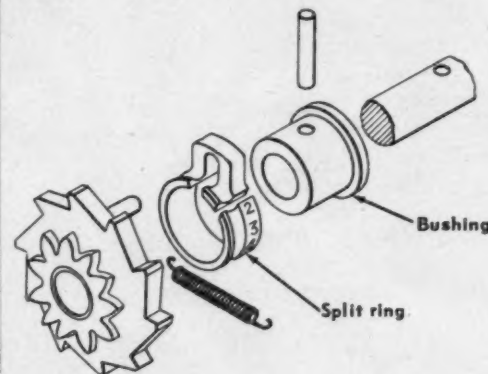
Friction Clutch

U. S. Patent 2,961,079; Walter Hanstein, Jr., assignor to Burroughs Corp., Detroit, Mich.

Designed to transmit intermittent or continuous motion, this reversible friction drive clutch maintains a substantially constant output from a supply torque. Torque applied in one direction is greater than when applied in the reverse direction and torque transmitting parts operate by substantially continuous circumferential surface contact.

A driving member consists of a bushing mounted on the torque-applying shaft by pin or key. The bushing has a circumferential friction surface bounded at one end by a peripheral flange. The driven member is in the form of a split ring encircling and seated on the bushing against the flange. Ends of the ring are spaced apart to provide a clearance permitting the required wrap-around gripping action. This action is obtained by a coiled spring positioned in a peripheral groove. Ends of the spring are connected to a pin projecting from the face of a driven member. The lug is integral with the split ring and has a slot in which the pin is engaged.

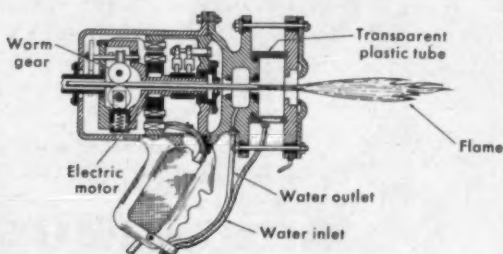
Both the bushing and the split ring are preferably formed of nylon because of its ease of fabrication, its excellent wearing qualities and its quiet operation.



Plasma Welding Torch

French Patent 1,228,371; Compagnie Francaise Thomson-Houston, Paris, France.

This single-arc torch utilizes the plasma phenomenon to obtain a more than 16,000F flame. The arc burns between a central rod electrode and a terminal piece provided with an axial nozzle. Water or other medium is injected at high pressure into a cylindrical chamber surrounding the arc. Injection is tangential, so the water stream rotates at high speed around the arc to create high-pressure superheated steam which stricture the arc and raises its temperature. Despite the 16,000F arc, the rotating water jacket effectively cools the nozzle, even allowing use of transparent plastic material for the cylindrical tube section of the chamber. Flame is visible and can be adjusted.

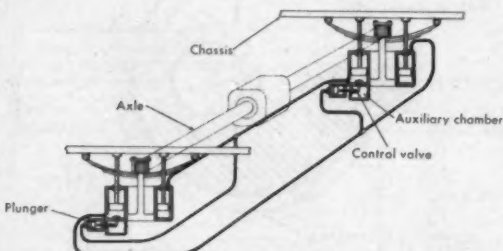


Vehicle Tilt Corrector

Italian Patent 598,695; Fortunato Constanzi, Italy.

Pairs of hydraulic jacks at each end of a vehicle's axles provide compensation during cornering to keep the body level, or tilted slightly inward.

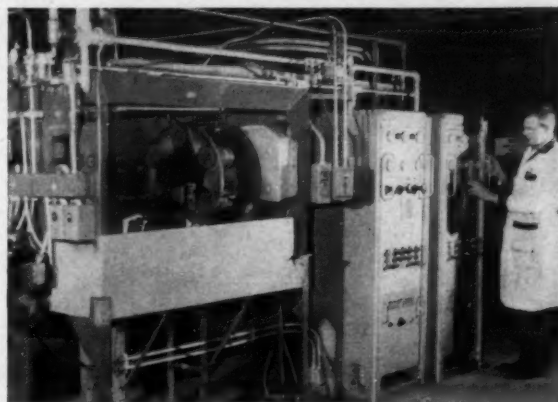
Jacks operate between body and axles. Each pair consists of one large- and one small-diameter cylinder. Spring compression at one axle end forces fluid out of the corresponding larger cylinder, through tubing into the smaller cylinder at the opposite end. The corresponding spring is forced to compress. Because the cylinder is smaller, the second spring will compress more, tilting the car into the curve. The same pressure opens a valve at the large, "resting" jack, so that fluid can escape when the small jack loads the spring.



ENGINEER'S NOTEBOOK

Flame sprayed metal increases wear resistance better than 10 times

AIDS WEIGHT REDUCTION



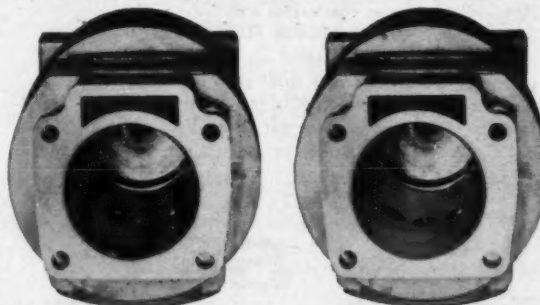
Automatic setup for metallizing inner walls of aluminum cylinders used in lightweight gasoline engines. Cabinet in foreground houses six-station rotary setup; automatic control panels are at right.

Many methods, including cast-iron cylinder liners and chrome plating, have been tested for wear resistance in lightweight gasoline engine blocks of aluminum.

Best of these methods experienced breakdowns in less than 400 hours. Now they are metallized with METCO Sprabond (molybdenum alloy) as a bonding agent, followed by a coating of sprayed steel alloy.

Test runs of over 4,000 hours show little or no wear of the metallized surface. Finish thickness is .007"; weight—a few grams. Cast-iron liners weighed almost ½ pound.

Cylinder at left machined ready for flame spraying; one at right has been metallized and hone finished.



Closeup of automatic six-station rotary setup. Cylinders are individually rotated at 150 rpm. Cylinder is loaded on table at Station 1, moved through Stations 2 and 3 for pre-heating by torch. At Station 4, bonding coat is applied by the gun nozzle which feeds into the rotating cylinder. Low alloy steel is applied at Station 5 and cylinder cools at Station 6. Cylinder walls are finished by honing.

New engineering data bulletin

Bulletin 136B—The METCO Flame Spraying Processes, provides basic engineering and application data on flame sprayed coatings of metals, ceramics, carbides and other high melting point materials. 16 pages. Send coupon for free copy.

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Flanged Mounting

Most pillow blocks offer easy assembly and rugged housings. But can they offer you low friction, self-aligning bearing operation and efficient sealing as well?

They can—if they're the SKF pillow blocks, and flanged mounting, shown here. Type SAF, for example, comes equipped with low-friction ball or spherical roller bearings that are inherently self aligning. And these bearings are effectively protected by Triple-Seal

rotating rings. Abrasives and corrosives can't get to them—oil or grease can't drip out.

Yet this is a standard SKF pillow block, that is competitively priced in spite of its combination of extra features. We make it for shaft sizes from 1/4" to 10 1/2", for mounting directly or with an adapter. A cast steel housing (SAFS) is available for heavy duty applications.

For details, call one of our twenty-four offices. 5938



Spherical, Cylindrical, Ball, Tapered and REED Miniature Bearings

EVERY TYPE—EVERY USE

SKF

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U.S. PAT. OFF.

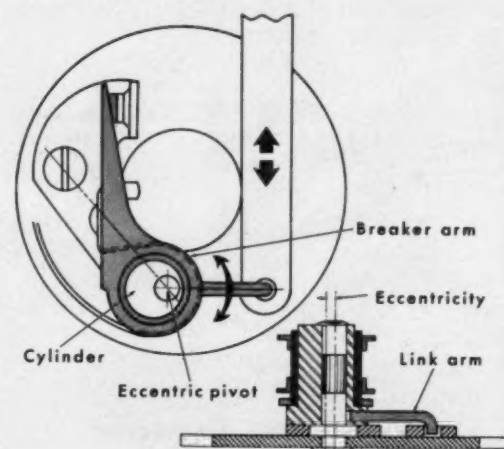
Circle 51 on Reader-Service Card for more information

Spark-Advance Regulator

Italian Patent 597,225, Fabbrica Italiana Magneti Marelli, Italy.

This spark-advance regulator provides irreversible operation which prevents breaker arm vibration. Jolts from the drive cam are not transmitted to the vacuum diaphragm unit.

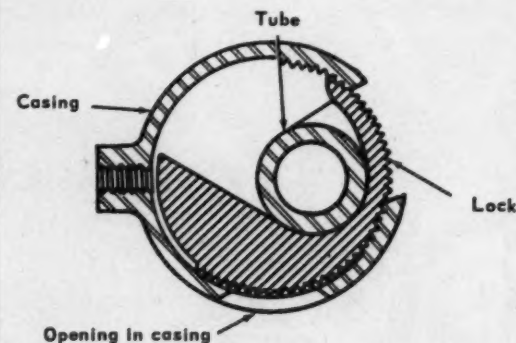
The breaker arm is mounted and free to rotate on a small cylinder. A pivot fixed on the support plate enters an eccentric hole in the cylinder and a link arm connects the cylinder to a shaft controlled by the vacuum diaphragm. Link arm displacement causes the cylinder to rotate about its pivot, changing the position of the breaker arm relative to the cam.



Cable or Tube Clamp

French Patent 1,162,757; Fernand Auzoulat, Paris, France.

A casing and a lock, both molded of plastic or similar material, constitute this patented clamp. The inside part, the lock, is provided with teeth on its outer surface. The casing has similar teeth on a portion of its inside surface. When the lock is inserted, the teeth engage and the fixture holds the cable or tube.



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in
compact
size...



HEINZE UNIVERSAL MOTORS

When you want power in compact series motors, Heinze Universal Motors provide high starting torque, variable speed, reversibility and high output. Originally developed for sewing machines and office machines, they are extremely flexible in design for a variety of uses not requiring constant speed. Flat sided models are especially adaptable for limited space.

Horsepower ratings are from 1/10 to 1/30. Load speed is 7,500 rpm. Standard voltage rating is 115V, AC/DC but motors are supplied for other voltages in AC or DC. Rotation is CW, CCW, or reversing. Optional mounting arrangements include tapped holes on flat side.

Send coupon for new catalog on Heinze Universal Motors — plus the complete line of Heinze sub-fractional horsepower motors and blowers.

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Please send new catalog on Heinze sub-fractional motors and blowers.

Name & Title.....

Company.....

Street & No.....

City & State.....

Circle 52 on Reader-Service Card

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

HYDRAULIC FLUID PRESSURE-OPERATED DEVICE FOR CLUTCHES

U S Patent 2,967,396; Richard L. Staadt, assignor to International Harvester Co., Chicago, Ill.

CONSTANT-PRESSURE EXPANSION VALVE

U S Patent 2,967,403; Harold T. Lange and Edward F. Kounovsky, assignors to Sporlan Valve Co., St. Louis, Mo.

FRICTION CLUTCH

U S Patent 2,967,435; Howell N. James, assignor to International Harvester Co., Chicago, Ill.

POWER TRANSMISSION

U S Patent 2,967,488; Duncan B. Gardiner, assignor to Vickers Inc., Detroit, Mich.

PNEUMATIC ACTUATOR

U S Patent 2,967,511; Howard M. Geyer, assignor to General Motors Corp., Detroit, Mich.

SELF-LOCKING CYLINDER ASSEMBLY

U S Patent 2,967,512; Raymond W. Born, West Covina, Calif.

LIQUID-TYPE CHECK VALVE

U S Patent 2,967,540; Donald A. Diehl, assignor to The Fyr-Fyter Co., Dayton, Ohio.

MAGNETICALLY ACTUATED SLIDE VALVES

U S Patent 2,967,545; Franz Josef Schmidt, Schmitten (Taunus) Hessen, Germany.

BRAKING APPARATUS

U S Patent 2,967,590; Jack B. Ottestad, assignor to General Dynamics Corp., San Diego, Calif.

SMOOTHLY OPERATING CENTRIFUGAL CLUTCH

U S Patent 2,967,597; Richard Binder, assignor to Fichtel & Sachs A. G., Schweinfurt (Main), Germany.

TUBE COUPLING

U S Patent 2,967,723; Barry B. Willis, assignor to On Mark Couplings, Inc., Los Angeles, Calif.

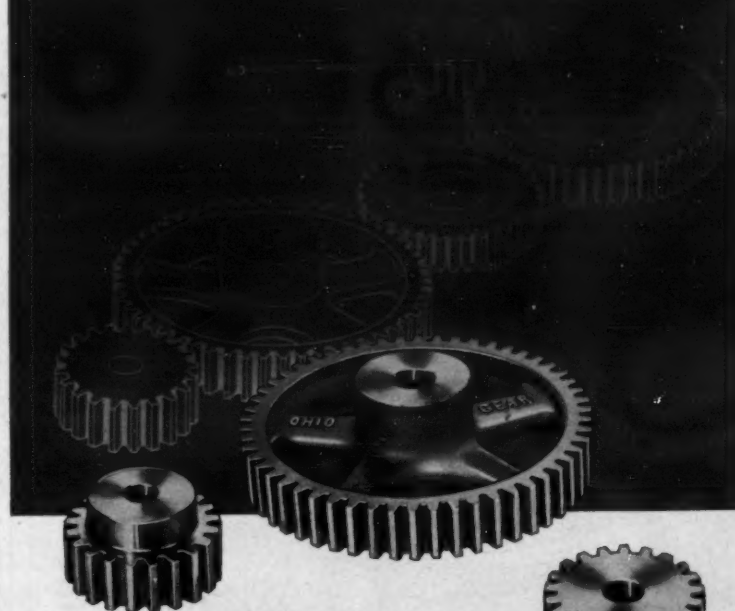
ACCUMULATOR

U S Patent 2,967,744; Robert H. Davies, assignor to Parker-Hannifin Corp., Cleveland, Ohio.

ELECTRICAL CONNECTOR

U S Patent 2,968,020; Harry E. Barnhart, assignor to The Bendix Corp., Delaware.

20% Stronger GEAR TRAINS



with OHIO 20° P.A. Gears

You can add as much as 20% more strength to the gearing in your product, simply by switching to OHIO 20° pressure angle gears.

Ohio offers the only complete line of 20° P.A. gears which have exactly the same face width as the older standard 14½° P.A. type.

Existing designs need not be altered to gain this extra strength because you can substitute a 20° P.A. gear train without changing ratios or center-distances. OHIO's 20° P.A. gears are available for immediate delivery from local stock and they cost no more than 14½° gears.

20° pressure angle gears are stronger because they have a thicker tooth profile with less undercut. For full information on OHIO's 20° pressure angle gears, call your local OHIO distributor or write OHIO GEAR direct.



Get Your Copy
Of Ohio Gear's
Complete Stock
Gear and Speed
Reducer Catalog.



Manufacturers of gears and speed reducers - both stock and special



OHIO GEAR Company

1311 East 179th St. • Cleveland 10, Ohio

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FOR EXCELLENCE IN SEALING RELIABILITY



Stillman has an enviable reputation for reliability in the development and production of O-Ring seals for military and industrial applications. The most difficult sealing requirements are met with ease because of Stillman's long years as sealing specialists for military projects where precision and reliability are prerequisites. Stillman O-Rings are produced in a complete range of sizes and compounds for both static and dynamic sealing. These O-Rings have found complete acceptability for the most critical applications. Unusual compounds such as silicone and Viton are standard in Stillman O-Rings. Still more exotic compounds are coming from Stillman laboratories each day, to meet the increasingly complex demands of present-day technology.

For further information, write to:

**STILLMAN RUBBER
COMPANY**

CLEVELAND, CAL. / CLEVELAND, O. / ENGLEWOOD, N.J.

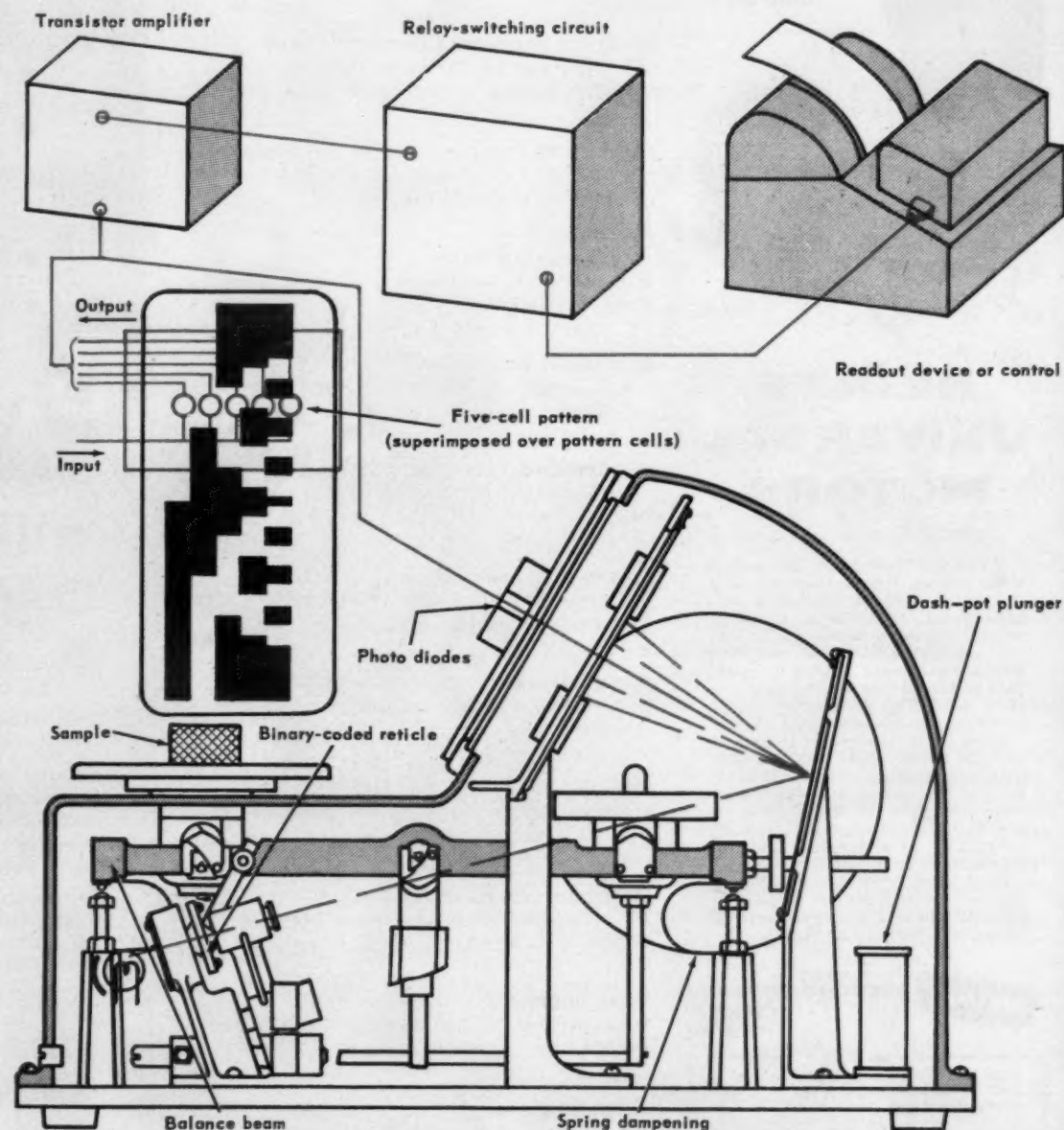
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DESIGN DESIGN IDEAS NEWS

ELECTRICAL DEVICES

Photo-Diodes Read Binary Coding to Provide

E. J. Stefanides, Central States Editor



ITEMS TO BE WEIGHED are placed on scale for comparison with desired standard. As scale moves to balance, binary-coded reticle moves through optical projection path and casts shadow across photo-diodes arranged in binary code. Changes in signal are amplified by printed-circuit transistor

amplifier and fed through system of relays to electrically controlled adding machine or to control devices. Adding machine showing continuous record of weight condition can be used to plot sigma-distribution curves or to detect deviations in quality or process.

For Free Reprints of the Above Article, Circle 528 on Reader-Service Card

DESIGN NEWS—FEBRUARY 13, 1961

Quality-Control Data



SYSTEM can be used to provide accuracies to ± 5 mg for up to 30g loads and maximum weight ratings up to 150 lb with $\pm \frac{1}{2}$ oz accuracy. Scale balance beam is equipped with magnetic or hydraulic damping devices to bring it to rapid balance.

A new precision weighing device uses photo-diodes arranged to read a binary-coded light signal and, thus, automatically provide data for quality and process control. Parts or units moving in an assembly line or process flow line are automatically placed on the scale for comparison of their weight with a fixed standard.

Deviations from the standard, as determined by the deflection of the beam, move a reticle pattern attached to the beam through the path of an optical projection system. This casts a binary-encoded light and shadow pattern across the photo-diode cluster arranged to decode the pattern.

The signal change caused by the shadow movement is amplified by a transistor amplifier and fed through a series of relays to provide an output signal. The output signal then is supplied to either an electrical computing-adding machine or to a variety of sorting and other control devices.

With binary coding and using up to seven photo-diodes, as many as 128 different weight conditions can be detected by the precision scale and recorded or compensation accomplished. This can be done automatically at rates up to 120 per minute, depending on information that must be read out, accuracy needed and total load of part being weighed.

This precision weighing device is designed and manufactured by the Exact Weight Scale Co., Columbus, Ohio.

For Free Reprints of the Above Article,
Circle 528 on Reader-Service Card



The Bellows Air Motor[®] Makes Pneumatic Circuits Easier to Design • Easier to Build

The Bellows Air Motor makes designing for air operation a lot easier and less costly. Its built-in directional valve, built-in speed controls, and its single air connection (which can be flexible hose) is true space-saving design—makes it fit perfectly in cramped quarters or on moving machine elements. And from the standpoint of final design, the Bellows Air Motor offers faster action, more positive control, and minimum maintenance.

The Bellows Air Motor is available in various mounting styles, in five bore sizes ($1\frac{1}{4}$ ", $1\frac{3}{4}$ ", $2\frac{1}{2}$ ", $3\frac{5}{8}$ " and $4\frac{1}{2}$ "), and in any stroke length. Optional built-in valves include 8-12v low voltage control, 115v JIC electric control, manual or pneumatic controls, thus giving the design engineer the widest latitude in control systems.

Full data on Bellows Air Motors is in Bulletin BM-25, free on request. Write Dept. DN 261, Bellows-Valvair, Akron 9, Ohio.

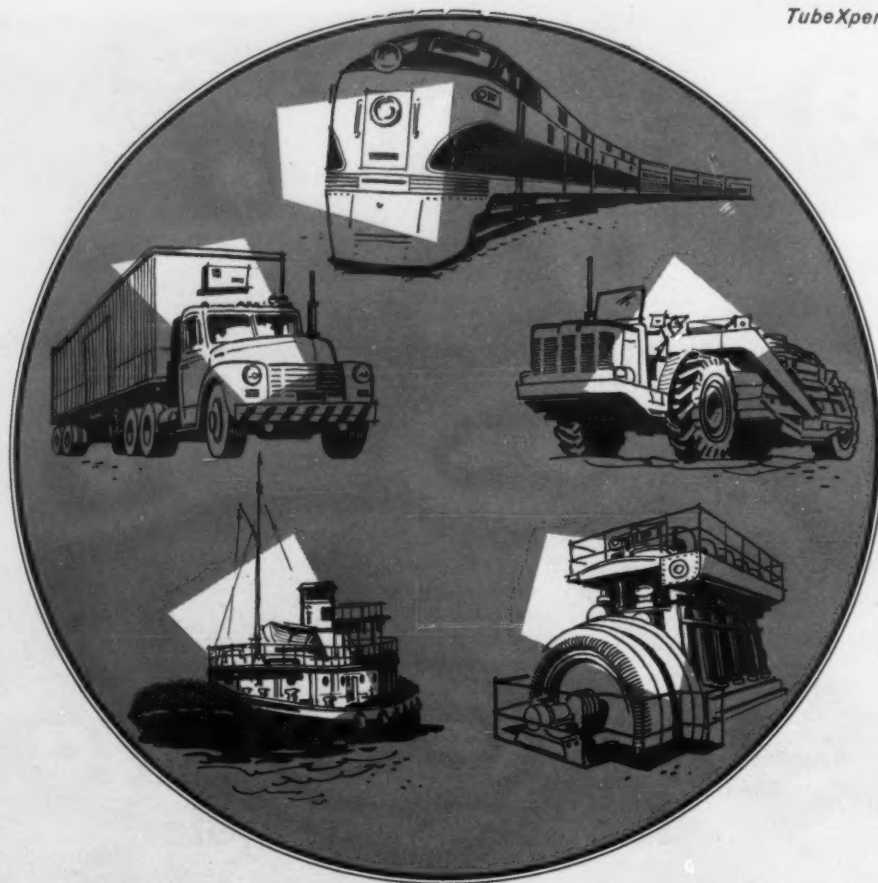
Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

996-C

Circle 55 on Reader-Service Card for more information



Feedlines for hungry horsepower... diesel fuel injection tubing by Superior

Fuel injection systems are the heart of thousands of diesel-powered trucks, locomotives, roadbuilding equipment, electric generators, and marine power plants. The tubing that conveys the fuel from injection pump to nozzle assembly is an important component. It must resist the stresses of pressure and vibration, yet be ductile enough to be cold swaged and upset and be cold formed into loops and bends without excessive springback. It must have a clean ID, tremendous burst strength, and high fatigue resistance. Superior diesel fuel injection tubing is just such a premium product.

Type C-1008 and Type MT-1010 carbon steel tubing are most commonly specified for this application, but alloy and stainless steel tubing for pressures above 9000 psi and greater corrosion resistance is available. Superior also makes tubing for many other applications—supplies both general and special purpose tubing for aircraft, missiles, electrical, electronic,

chemical, hydraulic, dairy and nuclear, to name a few. For complete information, write Superior Tube Company, 2002 Germantown Ave., Norristown, Pa.

SOME REASONS WHY SUPERIOR FUEL INJECTION TUBING IS A PREMIUM PRODUCT

- It will handle pressures to 9000 psi, is hydrostatically tested to various pressures according to specification
- It is cold drawn, dead soft annealed, and seamless
- It is ID conditioned to remove fissures and other defects
- It is free from ID radial cracks deeper than .005 in. or 5% of wall thickness, whichever is less
- It is annealed at finish in controlled atmosphere furnaces to produce a soft, ductile and scalefree material
- Fracture tests are performed when requested

Superior Tube

The big name in small tubing
NORRISTOWN, PA.

All analyses .010 in. to 3/4 in. OD—certain analyses in light walls up to 2 1/2 in. OD

West Coast: Pacific Tube Company, Los Angeles, California • FIRST STEEL TUBE MILL IN THE WEST

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IDEAS...

ELECTRICAL DEVICES

Photoflood Bulb, Selenium Cell

Lars G. Soderholm, Midwest Editor

A photographic photoflood light source is used to examine the transparent qualities of plastic samples in a low-cost light transmission opacity tester. A selenium photovoltaic cell provides spectral response in this instrument.

Plastic molders and extruders are being forced, through progress in materials, to use various new types of quality control instruments. A small plant usually cannot afford expensive test equipment, so it must find less expensive apparatus that can closely duplicate the higher-priced equipment.

Attempts to build a light transmission or opacity tester using conventional incandescent lamps in conjunction with a photographic light meter or photocell failed because results are very hard to correlate. The incandescent bulb produces light in the red and infrared range with practically no ultraviolet or blue light. This biases the reading so it does not compare with similar spectrophotometer values.

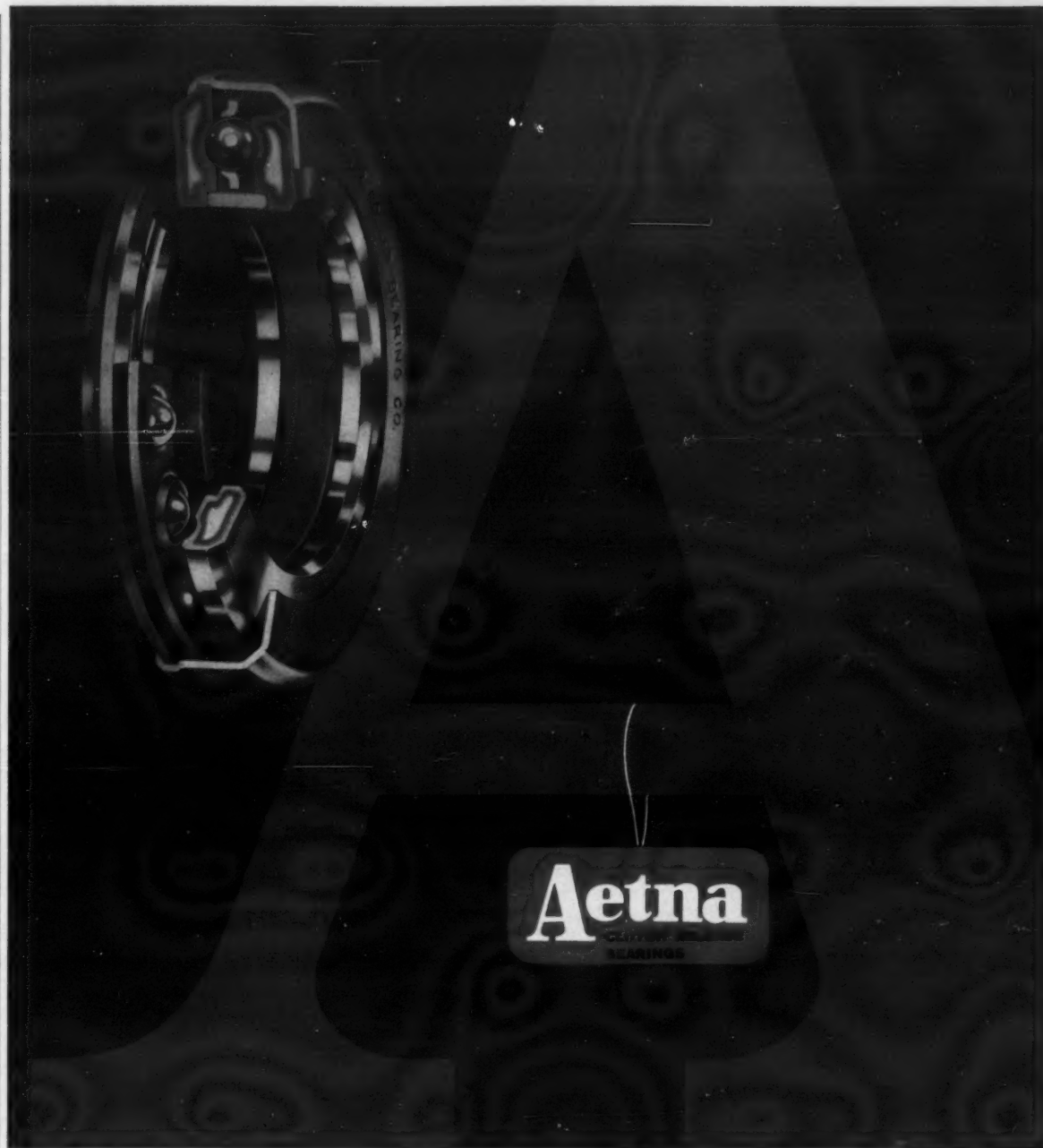
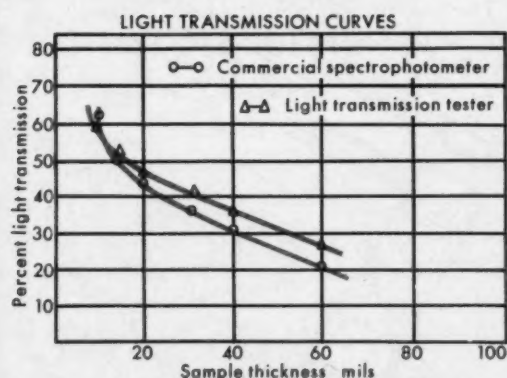
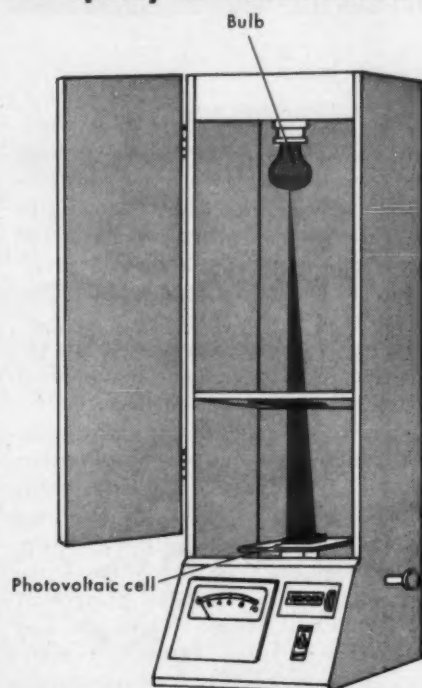
In this test apparatus a photoflood light was used as the light source because it covered the complete range of light from blue to red in the spectrum. To get a reading of the light values, a selenium photovoltaic cell was used because its response approximates that of the human eye, extending from 22 Angstrom units (ultraviolet) to 7400 Angstrom units (infrared).

In operation a sample is placed on the holder and a reading taken in direct percentages. A wait of 15 sec is recommended to stabilize the bulb before the reading. The meter is zeroed by adjusting rack and pinion sample holder. After the reading, the sample is removed and the meter checked to make sure it goes back to a 100 percent reading.

This machine was made for less than \$100 in parts and labor. While it is not intended to compete with more expensive instruments, a graph has been made and used comparing results with those of a spectrophotometer on a particular series of plastic material. Both instruments produce consistent curves and provide a commercially acceptable accuracy in determining light transmission values.

The light transmission tester was devised by C. L. Andrews and D. E. Pittan at the Materials Engineering Laboratory of Chicago Molded Products Corp., Chicago, Ill.

Test Opacity of Plastic Sheets



LISTEN . . . THEY'RE SO QUIET Put an Aetna bearing to the noise test and listen. Aetna bearings are quiet. They run smoothly and silently on and on without a trace of crackling or whine. This is because Aetna bearings are sound tested under prescribed load to uncover all traces of dirt, chatter, groove wobble, tight cage, and other imperfections. Sound testing is an important part of our quality control. And it assures you of consistently dependable bearing performance for your applications. For information on the complete line of Aetna ball and roller bearings, call your Aetna representative listed in your classified directory or write for General Catalog and Engineering Manual.

AETNA BALL and ROLLER BEARING COMPANY | 4600 SCHUBERT AVE.
DIVISION OF PARKERSBURG-AETNA CORPORATION | CHICAGO 39, ILL.

ANTI-FRICTION SUPPLIERS TO LEADING ORIGINAL EQUIPMENT MANUFACTURERS SINCE 1916

Circle 57 on Reader-Service Card for more information





Flow Sheet

HOKE REPORTS ON FLUID CONTROL

WE'VE TOSSED A NEW BALL INTO AN OLD GAME

How Do You Gauge Protection?

Not that we're trying to put an end to our pressure gauge business, but the new Hoke gauge protector will save you quite a bit of money on gauge repairs and replacement. It will help soothe the savage temper of your maintenance man, which might be even more important.

The new 530 Series gauge protector prevents sudden pressure surges from damaging costly gauges. Mounted conveniently, and directly between the pressure source and the gauge, it can be set for any pressure protection point between 30 and 1000 psig and will handle inlet pressures to 3000 psig. Minimum burst pressure is 9000 psig, so you have a



good safety margin. Its widespread popularity among maintenance men is due to the fact that it does not have to be re-set when the pressure drops below the protection point.

Those more interested in technicalities should read this: The temperature range is -10° to $+200^{\circ}$ F, and the unit is usable in any clean gaseous service compatible with brass and Buna-N. It weighs only 5 1/4 ounces, and measures 1 7/8 inches from inlet to outlet. Both ends are 1/4 NPT female connections, so no adaptors or connectors are necessary for installation.

Specs are available, whatever your reason for wanting them—Write!

SEE OUR CATALOG IN SWEETS PRODUCT DESIGN FILE

The technique of molding polyvinyl chloride into ball valve parts is old hat. Even the unplasticized compounds of type I PVC have been kicked around for a while (with minor successes). But until now, no one has booted the ball for a goal.

Perseverance, determination, and the pursuit of economic reward have prompted us to offer a line of ball valves molded of the toughest grade of type I, unplasticized PVC. There are no foreign agents to contribute to a corrosive demise, even in most caustic services. It even meets the proposed new ASTM specification and has a tensile strength of 8500 psi. Those who have had PVC piping problems will profit from the new molding process that gives these Hokes dimensional stability and very high impact strength. Sensitive systems, human and otherwise, are safe from contamination—they're absolutely non-toxic. We've set 140° F. as the operating temperature limit, but occasional excursions to 160° F. won't do any harm.

All standard models are supplied with a concentric hole drilled thru the ball. They can be heat welded, or solvent bonded right in the line. Piping hook-up is even simplified by their coupling-like assembly. Your assistant can fit each half of the valve to a pipe end, then reassemble the valve without having to turn the pipe. Pressures to 125 psi are duck soup for these valves.

A maintenance man's delight, they can be cleaned and have their seats changed without leaving the pipe. Their light weight makes them ideal for use on long, unsupported spans of pipe.



Size-wise, we're offering them in 1/4, 3/4, 1, 1 1/2, 2, and 3 inch sizes, all NPT female connections.

You will command the eternal admiration of your colleagues when you install these valves. Be the first to show your rightful status by ordering a shiny new Hoke polyvinyl chloride ball valve. If pride of ownership hasn't motivated you at this point, the mere fact that you are behind the scientific times should move you to find out more.

It isn't necessary to tell us why you want the additional information. Just check the coupon below. We'll forward the facts in a plain, brown envelope.

WHAT'S NEW FROM HOKE?

Lots of things have been happening at Hoke. To be sure you're up to date on these developments in fluid control see your nearest distributor. He'll have something new for you every other month this year.

Hoke's Performance Guarantee — Every Valve Leak-Tested!

HOKE, INCORPORATED
89 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ PVC Ball Valves
- ☐ 530 Gauge Protectors
- ☐ Flow Sheet
- ☐ "What's New"
- ☐ Complete Catalog GC 960

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

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IDEAS...

ELECTRICAL DEVICES

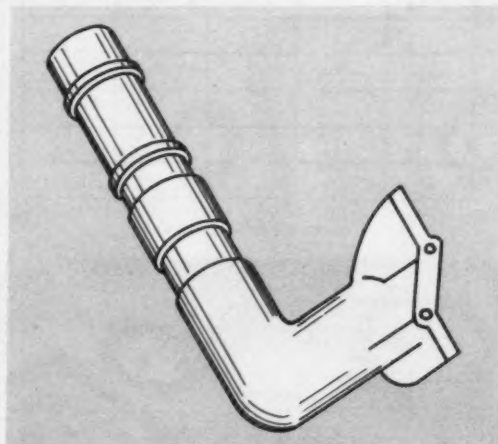
Electric Windshield Washer

Robert L. Candlish, Detroit Editor

The operating time of an electric drive windshield washer system is controlled by a small glass-housed circuit breaker that also provides overload protection for the motor. The positive displacement washer pump-drive motor is a 12v d-c ceramic-magnet-field type fitted with silver-graphite brushes. Operating speed is 6000 rpm. Full-load current is 3 amps. The circuit breaker, a bi-metallic strip type, is housed inside the enclosure for pump and motor and is supported by a clip attached to the wire connector.

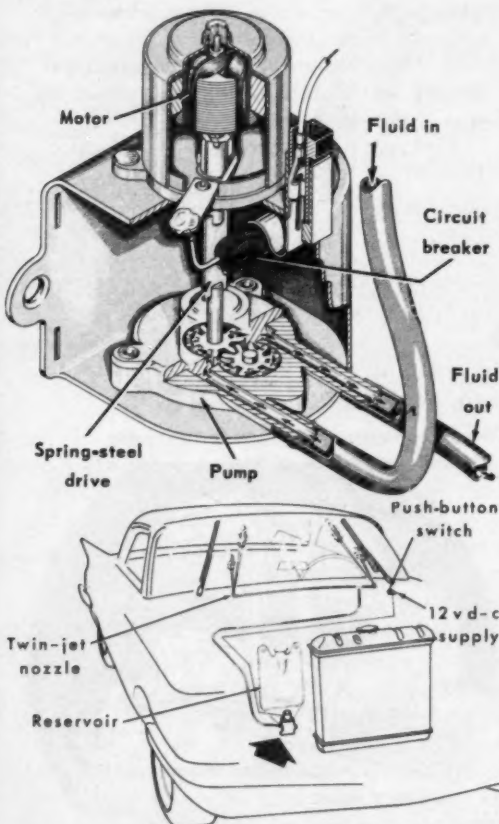
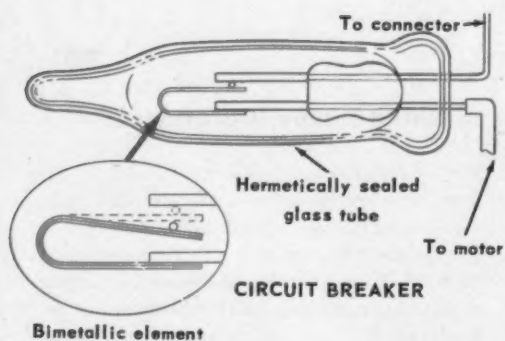
The washer system is push-button controlled; pumping is continuous while the control button is depressed for a period of about 20 sec at which time the breaker interrupts the circuit. Overload protection also is provided should foreign material enter the pump, stopping its rotation. Drive from motor to pump is via a flat spring steel strip. This eliminates alignment problems and provides a cushion when starting to reduce starting current. Delivery pressure to washer nozzles is 13 psi minimum.

The electric windshield washer system is offered by the Chrysler Corp. for its 1961 Chrysler and Imperial cars.



SPRAY NOZZLES are cold formed from brass tubing bent into L shape and flattened at end. Holes are made during flattening process by forming tubes over length of 0.029-inch piano wire and then withdrawing wire.

Uses Glass Tube Circuit Breaker



CORROSION-RESISTANT MATERIALS are used extensively in washer pump and fluid distribution system. Pump body is molded acetal resin. Rotors are sliced from precision brass extrusions. Rotor shafts are stainless steel. Shaft and motor armature operate in "Oilite" bearings. Assembly mounting bracket is cadmium-plated steel. Aluminum cover protects whole assembly. Non-staining ozone-resistant rubber tubes conduct washer fluid to corrosion-resistant brass nozzles.

WEATHER

Fair, Mild

T-J

TOMKINS-JOHNSON TRIBUNE

★★★★★

FINAL

THE TOMKINS-JOHNSON CO. • 2425 W. Michigan Ave. • Jackson, Michigan

INCREASED PRODUCTION... CREATES PRICE ADJUSTMENT on T-J Squair Head Cylinders

JACKSON, MICH. JAN. 3 (TP)—"Due to the tremendous initial response and the continuing acceptance and purchase of the new Tomkins-Johnson Squair Head Cylinders, it has been possible to lower the basic price," according to T-J personnel. In effecting this price cut, Tomkins-Johnson has again proven that acceptance of a quality product and the inevitable increase in manufacturing volume CAN economically justify a price reduction *WITHOUT* jeopardizing quality.

The T-J Squair Head Cylinder, an interchangeable air cylinder for any pneumatic power application, was first introduced by Tomkins-Johnson in 1958. It was an immediate success because of

its availability in a wide range of bore sizes and strokes . . . as well as the standard quality features, including the new T-J Super-Cushion for air cylinders.

Other Standard Features

Other standard T-J features that allow the T-J Squair Head Cylinder to retain its high quality comparison over other makes of air cylinders and still give you lower price are; solid steel heads and mounting plates, hard-chrome plated bodies and piston rods, leak-proof cylinder head to body construction, heavy duty, high tensile ground and polished chrome, plated piston rod, and many more . . . STANDARD

AT NO EXTRA COST.

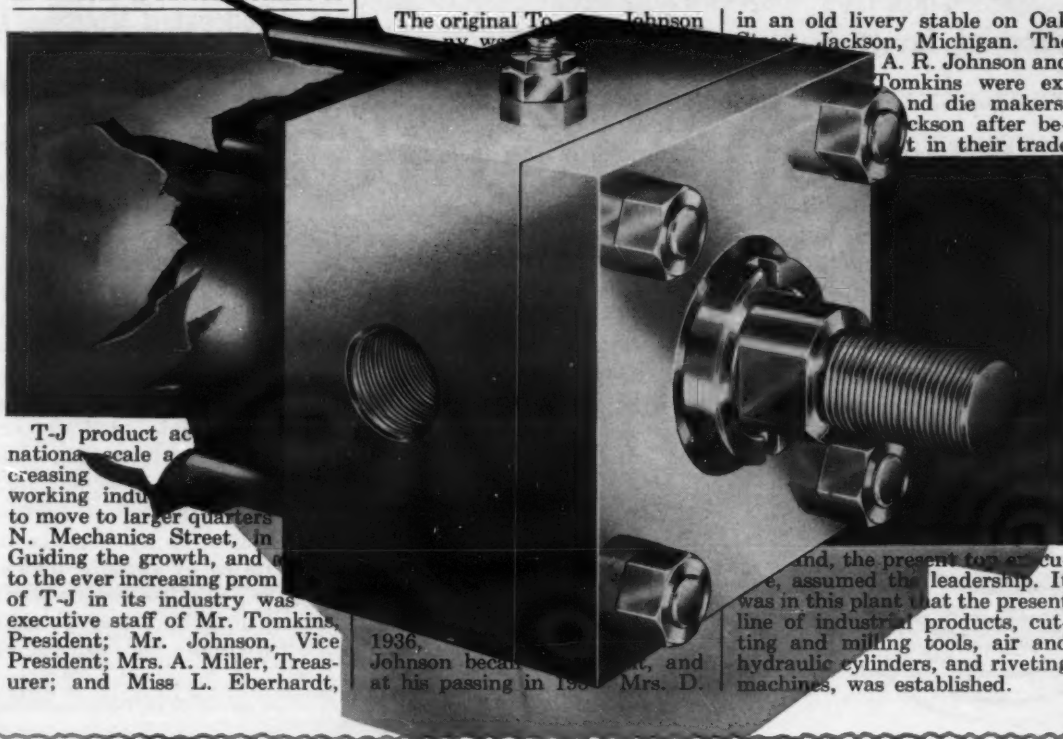
Tomkins-Johnson, by virtue of the announced lower cost on its Squair Head Cylinder, wish to thank their customers for their initial acceptance which has been such a contributing factor in this price reduction.

T-J Produces Complete Line

Tomkins-Johnson also produces a complete line of hydraulic and pneumatic cylinders for *EVERY* power drive application . . . including the very popular Spacemaker. If you need further information or complete catalog material, write T-J direct, or request it from your T-J sales representative.

The Tomkins-Johnson Company was founded in 1917

The original Tomkins-Johnson Company was founded in an old livery stable on Oak Street, Jackson, Michigan. The A. R. Johnson and Tomkins were experienced die makers, and Jackson after becoming a leader in their trade.



T-J product acceptance on a national scale is increasing working industry to move to larger quarters N. Mechanics Street, in Guiding the growth, and to the ever increasing prominence of T-J in its industry was executive staff of Mr. Tomkins, President; Mr. Johnson, Vice President; Mrs. A. Miller, Treasurer; and Miss L. Eberhardt,

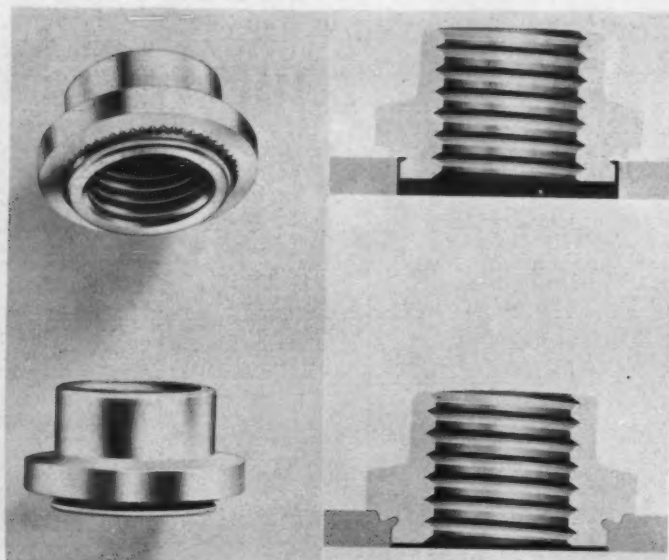
and, the present Tomkins-Johnson, assumed the leadership. It was in this plant that the present line of industrial products, cutting and milling tools, air and hydraulic cylinders, and riveting machines, was established.

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NEW PRODUCTS

MECHANICAL

For more information on products described, circle on the Reader-Service Card the numbers appearing opposite the story headlines and drop the card in the mail.



Self-Locking Fasteners

301

Prevent Mating Bolts from Loosening under Vibration

Recommended where vibration resistance and flush-mounting are required, this one-piece, all-metal fastener holds securely in a punched or drilled hole wherever wrenching stops. The self-locking swage nut is a simple method of attaching load-bearing threads to sheet metal or other thin-sectioned assemblies, particularly for blind fastening in locations where ordinary nuts would be inaccessible. It carries assembly screw loads to 160,000 psi tensile strength. On assembly in holes punched or drilled to specified tolerances, self-locking nut produces a completely flat surface on reverse side. When installa-

tion pressure is applied, fastener displaces metal around edge of hole and forces it into retaining groove of nut. The fastener can be used in sheet material from 0.020 inch thickness or greater, with hardness up to Rockwell C27. It can also be applied in steel as well as copper, Monel and aluminum. Only one tool is required for installation. The unit is made from alloy steel, heat treated, and is available cadmium plated in sizes 2 through 1/2-inch.

Standard Pressed Steel Co., Jenkintown, Pa.

Self-Locking Insert

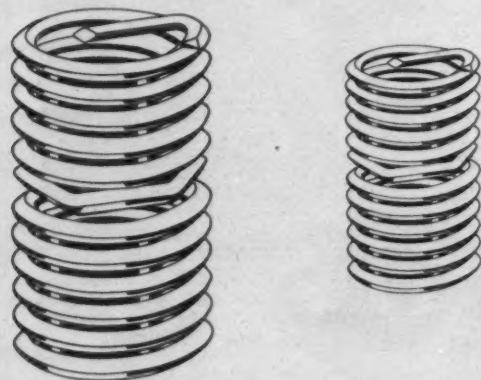
302

Eliminates Locknuts, Lock Washers, Lock Wiring

A self-locking insert eliminates seizure and galling at 1200F. Made of Inconel "X" wire, formed to a diamond shape and coiled to provide thread, "Screw-Lock" attains its high locking effect from a grip coil midway in its length. This coil is poly-

gonal in shape rather than circular with respect to the other threads. As bolt is screwed through threads of insert, it forces flat chords of grip coil to conform to usual thread shape, while chords maintain a uniform locking effect on bolt, even after repeated assembly and disassembly. A full range of UNF sizes from 10-32 through 1/2-20 is available, with delivery immediately in the 1/4-28 series in 1 1/2 and 2-inch diameter lengths.

Heli-Coil Corp., Danbury, Conn.

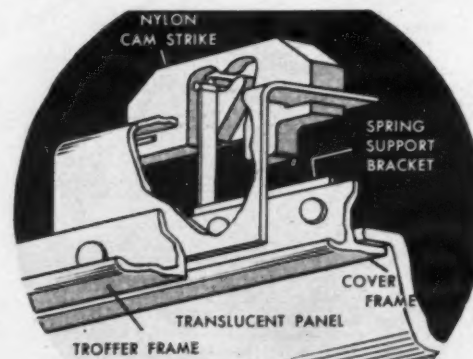


Concealed Release Latches

303

Push to Open, Push to Close

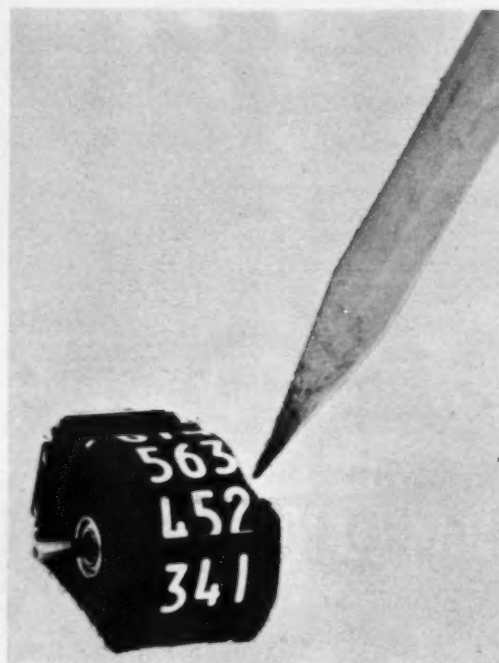
Concealed gravity push-release latches require only 1/16-inch vertical release travel and operate with a push-to-open, push-to-close action. Since latch is concealed and has minimum travel, frame and door may be designed to eliminate light leaks. Adapted to lighting fixtures, incandescent or fluorescent, of a door or troffer design, nylon cam strike is engineered to allow latch to function with $\pm 1/16$ -inch horizontal misalignment, allowing broad manufacturing or assembly tolerances. Nylon cam snaps on; mating part is assembled with only one screw. Maintenance of fixtures using catch is said to be safe and simple, allowing integral unit design with no removable parts requiring a third hand. Integral stop feature



prevents over-ride or hang-up, eliminating danger, damage or malfunction during operation.

Stanley Works, Dept. PRL, 4842 Lake St., New Britain, Conn.

**Improve Readability
For Below-Eye-Level Instruments**

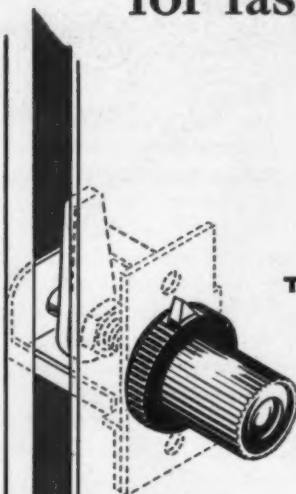


In this line of compact counters, designated series 1736, there is a 0.220 high figure and 0.305 opening. Maximum figure representation results from removal of transfer pinions from an exterior location to within unit, allowing use of larger number wheels. Internal pinion units have a static torque of 1.00 oz-in over a temperature range of -55 to 100C. Three or four wheels of figures are available, as well as plate extensions with two stationary zeros and decimal point indication. Counters may also be furnished with left wheel stops. Frame, and caps are black anodized aluminum with drive of stainless steel. Drive shaft runs in miniature precision ball bearings and may be obtained as left or right extension. Actual counting is performed by 0-9 unit wheels which register 10 counts per revolution. Speed is 750 rpm intermittent and 300 rpm continuous. Numeral styling conforms to MS-33558.

Veeder-Root Inc., 70 Sargeant St., Hartford 2, Conn.

Standards with unique features for fastening doors and panels

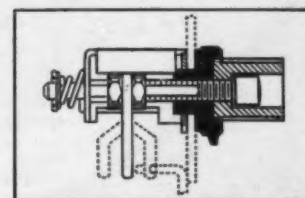
Southco adjustable pawl fasteners are easy and economical to install, give a "class" appearance to equipment. They apply controlled pressure to seal tightly and stop rattles.



TWIN KNOB CONTROL—NO. 46

The pawl engages the frame when the actuator is turned 90°. A bright chrome button in the center of the knob is preset for the amount of pressure to be exerted by the fastener. After the pawl engages the frame, the knob is turned until the button is flush with the knob surface. Preset pressure is thus obtained.

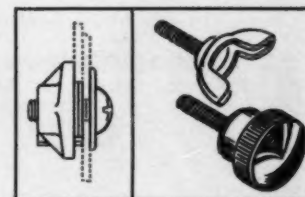
Materials Body: Cadmium plated steel
Knob: Black nylon



MINIATURE ENVELOPE—NO. 45

Requiring a minimum of space inside and outside, this fastener latches on a 1/4 turn and additional turning pulls up the door or panel against its frame. The nylon pawl operates smoothly against metal and provides exceptional wearing qualities.

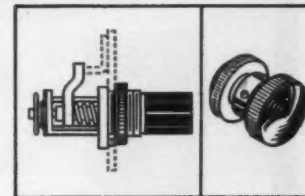
Materials Pawl stop and washers: Carbon steel, cadmium plated
Pawl: Nylon, natural



SMALL, HEAVY-DUTY MOUNTING—NO. 48

Small, rugged, compact. One quarter turn closes, additional turning tightens. Quickly installed with a single mounting nut. Three sizes cover every frame thickness from .000 to .750. Can be supplied with flatted shaft for your knob.

Materials Body and pawl: Steel, cadmium plated
Knob: Black nylon



© 1960

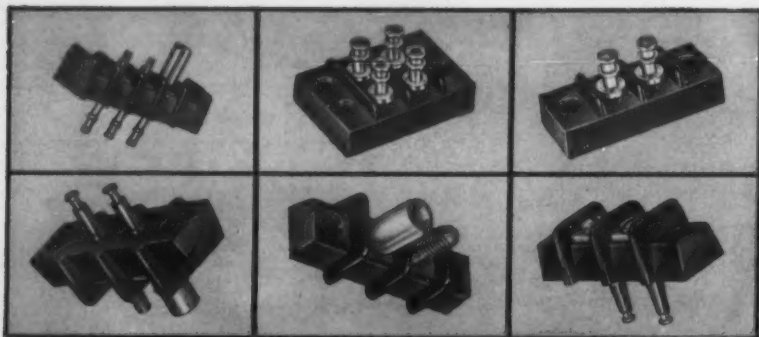
FREE!

Your copy of Southco Fastener Handbook containing engineering data on wide selection of fasteners. Write to Southco Division, South Chester Corporation, 232 Industrial Highway, Lester, Pa.



SOUTHCO FASTENERS
LION

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Kulka STUD AND TURRET TERMINAL BLOCKS FOR WIRING CONVENIENCE

WRITE FOR
COMPLETE
DETAILS

For faster, better, and more appropriate terminations, Kulka offers all their popular terminal blocks with your choice of terminal. Now you can choose from regular screw-type, solder-turret, feed-through, threaded stud, or any combination of terminals to best suit your specific requirements. And, you can call your own choice of finishes—electro-tinned, silver-plated, or even gold-plated over silver. Kulka maintains complete design and consultation services to aid customers in the proper terminal selection. Send us your requirements, or...

KULKA ELECTRIC CORP.

633-643 SO. FULTON AVENUE, MOUNT VERNON, N. Y.

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POST
ELECTRONIC
PRODUCTS

Model K-1A — When the light beam is not interrupted—output relay is energized.

Model K-1B — When the light beam is interrupted—output relay is energized

Model K-2 — Photo-electric timer with adjustable (.05-10 sec.) output relay closure.

Model K-3 — Photo-electric stop-motion and jam detector:

K-3R — When light beam is interrupted for the present time delay-output relay is energized.

K-3F — When light beam interruptions cease for a preset time delay-output relay is energized.

Decitron

POST ELECTRONIC PRODUCTS

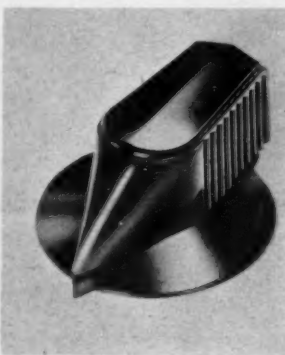
Division of Reid Brothers Company, Inc.
12 LOTHROP ST. / BEVERLY, MASS.

Circle 62 on Reader-Service Card for more information

MECHANICAL

Bar-Pointer Knobs 305

Designed in accordance with recommendations of the Department of Defense and Air Force studies for controls and control knobs, these units have been built to military specification MIL-K-3926. Available colors are black or gray per MS91528B. Knobs have a 7/8-inch swept turning radius and are available in the 90 series for 1/4-inch shafts. The two styles, a dial-skirted bar-pointer (illustrated) and a plain bar-pointer, are injection-molded of acrylonitrile-styrene co-



polymer per L-M-525 and contain an aluminum bushing per QQ-A-277, anodized per MIL-A-8625A. Socket type 4-40 UNC 3A set screws per FF-S-103 are supplied with each knob. A high-gloss mirror finish for industrial use or a non-reflective matte finish for military use are obtainable in either color. Other colors are available on special order.

Raytheon Industrial Components Div., 55 Chapel St., Newton 58, Mass.



with a DI-ACRO ROL-FORM DIE

Workmarking from forming sheet materials in press brakes and punch presses is greatly reduced and in many metals completely eliminated when formed with the Di-Acro Rol-Form Die. Hardened and precision ground rolls pivot smoothly in the die block to fold material without strain. You save costs by discarding elaborate and time consuming preparation and work methods, reducing polishing time, eliminating scrap parts. You also cut costs in press brakes and punch presses by reducing the number of dies needed and reducing set-up time.

One Di-Acro Rol-Form Die with a 60° upper die forms any angle to 60° and any thickness of metal to 1/8" just by adjusting the ram or bed of the brake. Where ultra-high finish material is to be formed, nylon inserts can be used in the die block to further reduce the possibility of work marks.

The Rol-Form Die is offered in five styles and in lengths from 6 inches to 12 feet for use in all sizes and models of press brakes and punch presses.

For ordinary press brake forming ask about
Di-Acro Standard Press Brake Dies.



Consult the yellow pages of your telephone book under Machinery-Machine Tools for the name of your nearest Di-Acro distributor or write us.

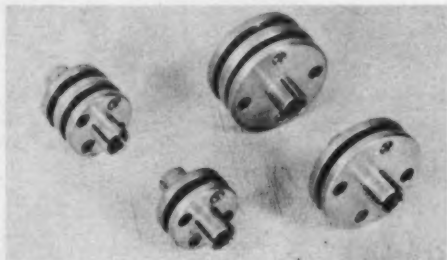
DI-ACRO CORPORATION
Formerly O'NEIL-IRWIN MFG. CO.
352 Eighth Avenue • Lake City, Minn.

Circle 63 on Reader-Service Card for more information

DESIGN NEWS—FEBRUARY 13, 1961

Miniature Flexible Couplings

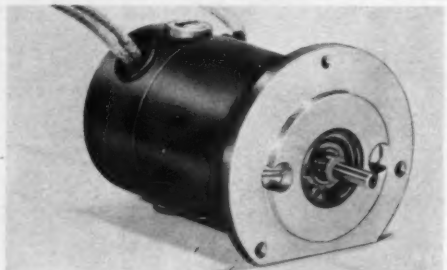
306



Split-hub and pancake-type flexible couplings range in size from $\frac{3}{8}$ to 1-5/16 inches OD with bore sizes from 0.0937 to 0.6875. Couplings are rated to transmit 15 to 40 lb-in of torque at high speeds. There are no moving parts to wear, no friction, nothing to be lubricated, and maintenance is at a minimum on these all-metal units. Units are torsionally rigid with no backlash and provide a smooth, constant drive. Finishes are to military specifications. Couplings absorb angular misalignment up to $7\frac{1}{2}$ deg, lateral misalignment up to 0.015 inch, and axial movement up to 0.060 inch in a single unit. They also dampen vibration effectively.

Dial Products Co., 19 Cottage St., Bayonne, N. J.

Precision Miniature Motor 307



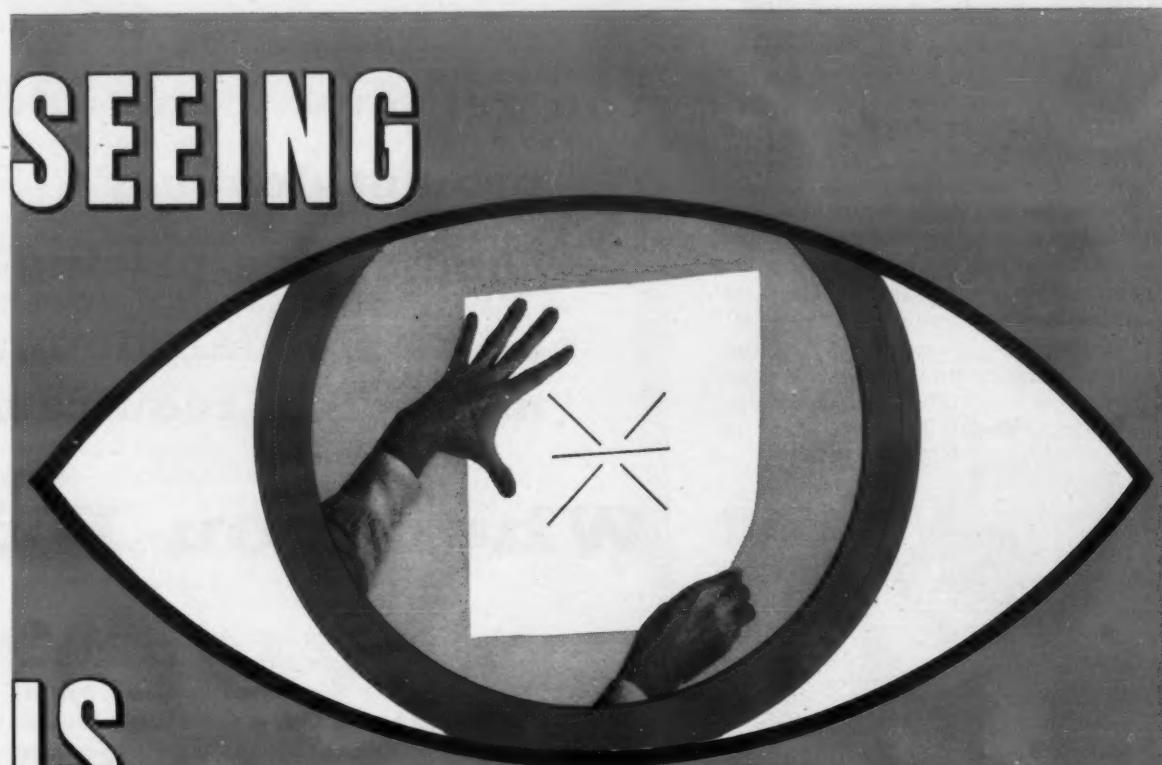
Weighing only 11 oz, this rotary component measures 2.562 inches long plus standard 1-inch shaft. The DS-105 may be built for d-c operation as shunt-series or split field motors, or as a-c series universal motors, in ranges from 6 to 115v. At 8000 rpm, d-c version develops 1/100 hp; a-c version develops 1/200 hp. Shaft diameter is a maximum of 0.250 inch. Outside diameter of steel shell housing around motor is 1.687 inches. Motors are obtainable with or without flange mounting bracket. Special adaptations of basic design can be furnished for use as a tachometer or rate generator.

Heinz Mueller Engineering Co., Inc., Dept. DN, 4725 W. Iowa St., Chicago 51, Ill.

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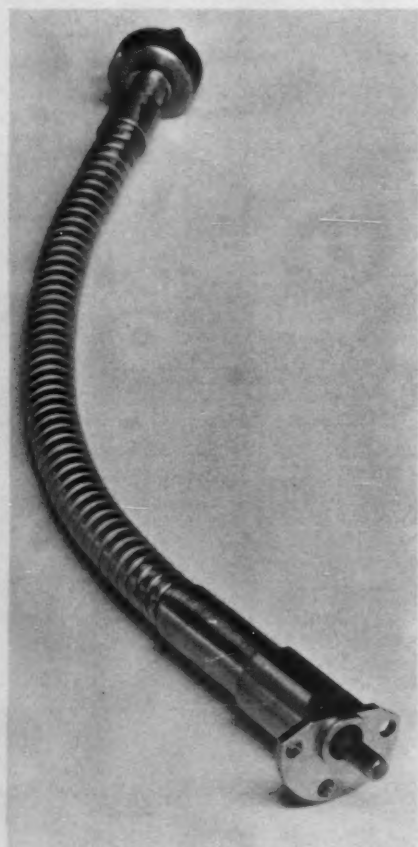
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Circle 64 on Reader-Service Card for more information

High-Temperature Flexible Shaft

308

A stainless-steel, high-temperature, flexible shaft with 5/16-inch diameter core is made up of layers of stainless-steel wire. Outer flexible interlocked casing and end fittings are also made of 316 and 321 stainless steel. Square fittings on end provide engagement and allow for slight changes in length due to varying torques. Ferrules are made to attach casing to



meet the special requirements of the application. Shaft is made to exacting requirements of aircraft industry and held to close tolerance. Deflection of flexible shaft in radians/lb-ft can be held to close tolerance also, and flexible shaft is available in desired length.

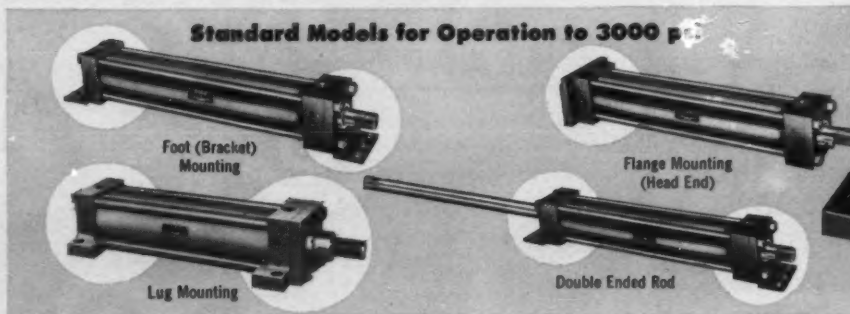
Stow Mfg. Co., 43 Shear St., Binghamton, N. Y.

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When you BUY VICKERS HYDRAULIC CYLINDERS

Typical of custom designs that can be furnished readily from Vickers new cylinder facility is this model built with extra rigidity and strength at both rod and clevis ends to overcome side loadings. For added corrosion resistance, stainless steel clevis pins, piston rods, retaining screws and grease fittings are used.



Choose the cylinder "outside" that's best for your installation—Vickers offers you a wide selection of standard mountings plus an almost unlimited range of special configurations. Alternate rod end threads . . . straight thread port connections . . . extra barrel lengths for bearing support . . . are among many available options.

- Working pressures to 3000 psi (non-shock)
- Hard chrome plated, ground and polished, high-strength alloy steel piston rods.
- Large ports hold pressure drop within desirable limits.
- Fast, accurate parts replacement is assured because all cylinders are individually registered.
- Honed barrels of heavy walled seamless tubing minimize friction and wear.
- Cushions can be provided—either head, rod or both ends.
- Your choice of automotive step-cut piston rings for maximum life or low friction "T" rings for applications requiring minimum leakage. Full size cast iron piston for maximum bearing support with either type seal.
- Synthetic rubber wiper ring is standard—metallic wipers available.
- Two large wrench flats on rod are standard—additional flats available on request.
- Fully meet JIC specifications.

New, separate plant facilities—devoted exclusively to the design and manufacture of hydraulic cylinders—assure prompt individual attention to your orders. Service stocks are maintained at all Vickers warehouses in the U.S. and Canada. For more application data and installation dimensions, call or write today for Bulletin 60-68

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Standard Models for Operation to 3000 psi

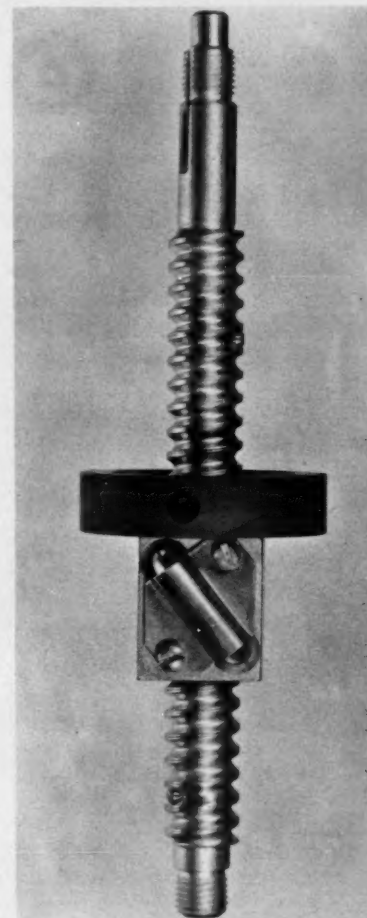


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Ball-Bearing Fastener

309

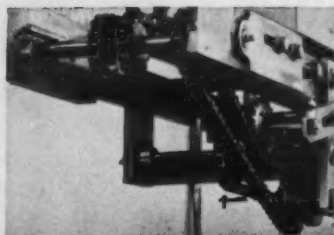
Freewheeling at both ends of travel in this ball-bearing screw is accomplished by providing a stop in the screw at each end of desired nut travel, and a free-wheeling device, which is an integral part of nut assembly. There is no need for limit switches or other costly devices to limit travel and prevent jamming or stalling. With exception of stops and freewheeling device, unit is the same as



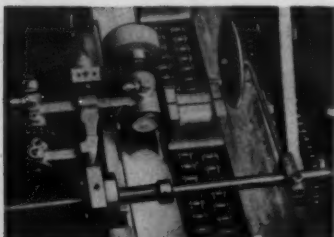
conventional ball-bearing screws and nuts. The high load-carrying capacity of the unit is the same as conventional screws of the same size. One unit having a ball circle diameter (pitch diameter) of 0.631 inch was tested for 45,000 cycles with a load of 500 lbs. Mechanical efficiencies range from 90 to 95 percent.

Saginaw Steering Gear Div. of General Motors Corp., Saginaw, Mich.

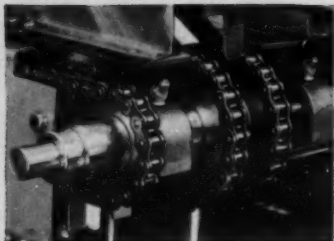
WHAT'S THE ANSWER TO THESE 4 POWER TRANSMISSION QUESTIONS?



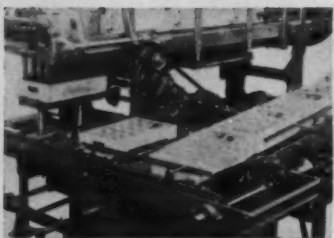
1 Do I have at my disposal a complete line of quality power transmission products, scientifically made to give the longest life expectancy, free from replacement worries, at competitive prices?



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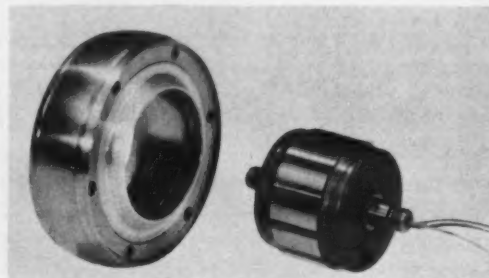


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MECHANICAL

Gyro Spin Motor

310

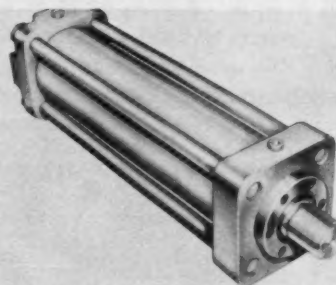


The model 108 gyro spin motor can be supplied to operate on 2 or 3-phase, 400-cycle power, or with an external capacitor will operate on single-phase power. Stator and external rotor are epoxy encapsulated with cast-aluminum squirrel cage. The rotary component will accelerate a 480 gm-cm² inertia ring in 50 seconds and operate at 23,000 rpm with 6w of power. Excluding the inertia ring, its dimensions are 1 1/4 inches OD by 3/4 inch long.

Curvin Development Co., 13740 Saticoy St., Van Nuys, Calif.

10,000 PSI Cylinders

311



Heavy-duty, double-acting hydraulic cylinders with choice of stroke length are manufactured in capacities of 50, 75, 100 and 150 tons. Bore sizes obtainable are 3 3/4, 4 1/2, 5 1/8 and 6 3/8 inches. Precision built for both "pushing" and "pulling" operation, a choice of mounting configurations is available in tie-rod extensions rod end, head end or both ends. Heat-treated, alloy-steel piston rods are ground and polished to 10-15 micro finish; heavy wall cylinder shells are bored and honed to 10-15 micro finish. Features include metallic rod wipers; self-adjusting, flange-type rod seals; heat-treated, alloy-steel tie-rods and nuts.

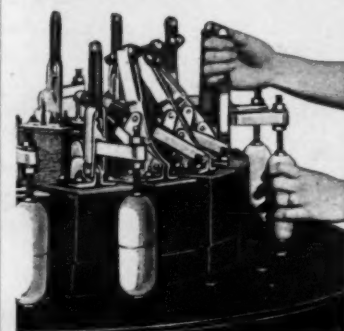
Owatonna Tool Co., Precision Hydraulics Div., 720 Cedar St., Owatonna, Minn.

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TOGGLE CLAMP VERSATILITY



JUST AS De-Sta-Co Toggle Clamps were used in the simple turn-table fixture pictured to firmly hold 3-piece molded-plastic net floats while being cemented into water-tight assemblies—YOU TOO will find De-Sta-Co Toggle Clamp versatility will answer your production needs. 13 standard styles and over 140 models to choose from—push, pull or lock with forces from 50 to 12,000 pounds!

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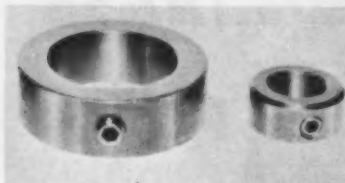
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Shaft Collars

312

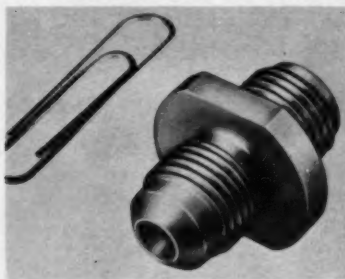


A line of steel shaft collars uses a special socket set screw, tested and proven to give greater holding power than the cut or knurled point types. Collars are available in sizes to fit all shafts ranging from 1/4 to 3 inches OD in 1/16-inch graduations, to meet close tolerance requirements of manufacturers. Made of black penetrate finish steel, collars serve a wide range of needs in all phases of industry.

Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, Ohio.

Check Valve

313



Built for operating pressures up to 1000 psi, this lightweight valve cracks at 5 to 8 oz-in and has a flow capacity of 1.0 gpm. The device permits free fluid flow in one direction and checks reverse flow. It handles any fluid compatible with the materials in a -65 to 450F range. Weighing less than 1 oz, valve is constructed with a one-piece leakproof aluminum body and hardened stainless-steel poppet and spring. Design features large straight-line flow passages for low pressure drop and minimum loss of power.

Fluid Regulators Corp., 313 Gillette St., Painesville, Ohio.

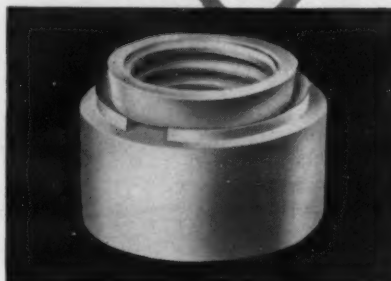


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PEM

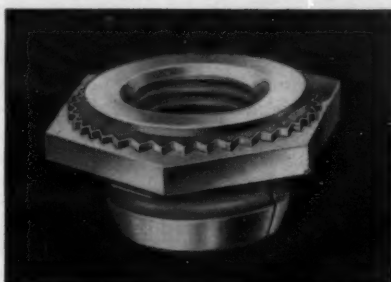
CAPTIVE THREADS for Production Fastening...

THE ORIGINAL SELF-CLINCHING FASTENER



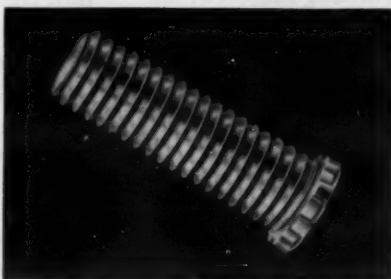
Made in steel, stainless steel, aluminum and Monel. Positively locked into prepared holes by any standard squeezing tool. For metal thicknesses down to .032". Sizes from No. 0 to 3/4". Bulletin CL.

SELF-CLINCHING, SELF-LOCKING NUT



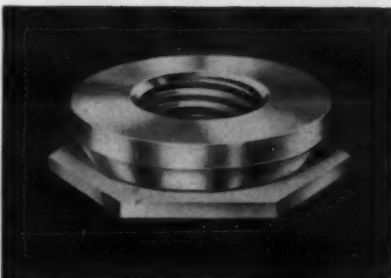
All metal (steel, stainless steel or aluminum) combines 2 functions in single light-weight, low-cost unit for sheet metal fastening. Suitable for installation in sheet thicknesses from .040" and up. Sizes from No. 2 to 10. Bulletin SL.

SELF-CLINCHING CAPTIVE STUD



Steel and stainless steel, designed for quick, easy flush-head installation in panels of cold-rolled steel, brass, copper, aluminum alloys and similar materials. Sizes No. 4 to 3/8". Lengths from 1/4" to 1 1/2". Bulletin FH.

SELF-CLINCHING FLUSH FASTENER



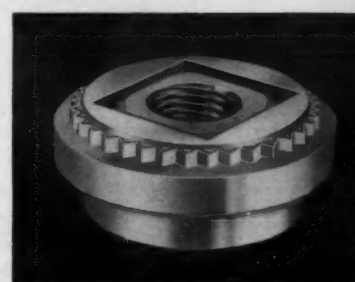
One-piece, stainless steel threaded insert installs in sheet thicknesses from .061" and up with flush mounting area on both sides of sheet. Suitable for materials with Rockwell Hardness of B-70 and less. Sizes No. 2 to 1/4". Bulletin FH.

SELF-LOCATING WELD FASTENER



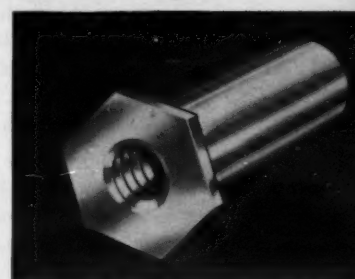
Steel and non-magnetic stainless steel. Nut is projection welded to part with extended shank protecting threads from weld splatter and serving as pilot in assembly. No. 2 to 1/4". Bulletin WN.

SELF-CLINCHING FLOATING NUT



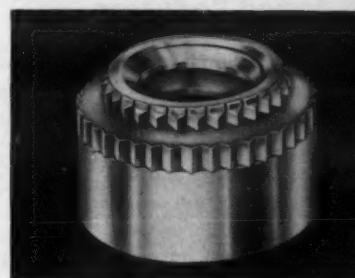
Carbon steel and stainless steel. Provides rapidly assembled nut anchor in sheet metal and compensates for slight errors (up to 1/16") in alignment of mating holes. Sizes No. 2 to 1/4". Suitable for sheet thicknesses from .040" up. Types AS and AC.

SELF-CLINCHING STAND-OFFS



Made in both blind and threaded-through types in steel, aluminum and stainless steel. Sizes No. 4 and No. 6. Overall lengths from 1/8" to 1 1/2". Suitable for use in sheet thicknesses from .040" and up. Bulletin SO.

SELF-CLINCHING SPLINE FASTENER



For hard metals and brittle materials — magnesium, glass laminates, epoxies, etc. Made in steel and stainless steel. Sizes No. 2 to 3/8". Type KF.

PENN ENGINEERING & MANUFACTURING CORP.

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MILWAUKEE—BLUEMOUND 8-6118
MINNEAPOLIS—GREENWOOD 4-6203

DALLAS—FLEETWOOD 7-5713

Variable Pitch Pulley 314



Design of this pulley eliminates parallel and angular misalignment. Maximum variation of speed is 30 percent in 5 turns. The unit may be precisely adjusted in small increments. Static and dynamic balance is held to 0.125 oz-in. Adjustment is accomplished by 2 splined grooves, 180 deg apart, which interrupt external threads. A set screw in female member provides positive register. All critical surfaces on assembly are machined to close tolerances. Pulley handles 3L, 4L and 5L belts. It is available in 3 bores— $\frac{1}{2}$, $\frac{3}{8}$ and $\frac{3}{4}$ inch.

Tann Corp., Congress Drives Div., 3750 E. Outer Dr., Detroit 34, Mich.

Worm Gear Speed Reducers 315

Ratios in this line of speed reducers extend from 4-1/7:1 to 95:1, with ratings from fractional to 175 hp. Plastic or aluminum is employed in design of extremely light, specially constructed radial fan which is effective in either direction of rotation. Fan is mounted on input side of worm shaft to efficiently scour finned outer wall of reducer. Mounting in this position eliminates extra expense and friction loss involved in addition of another oil seal.

Eaton Mfg. Co., Cleveland Worm & Gear Div., 3300 E. 80th St., Cleveland 4, Ohio.

NEW MCGILL® CAGEROL®

deliver up to 10 times the life of ordinary needle

You can confidently specify new CAGEROL cage type needle roller bearings to increase the expected life of your bearing applications, up to 10 times — as compared with end-guided needle bearings. This new McGill bearing will easily carry the usual needle roller bearing loads where shaft misalignment and speeds exceed the capabilities of ordinary needle bearings.

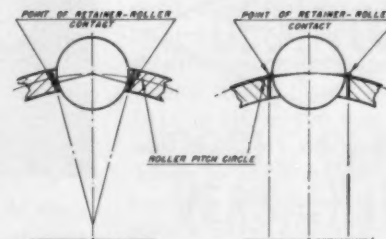
In this new McGill design a precision tubular cage spaces and locates specially heat treated crowned rollers. They are positively controlled to insure concentricity and prevent heat increases at higher speeds. The black oxide finish on retainers provides corrosion protection and stores lubricant in the porous surfaces. Friction is further reduced.

MR series CAGEROL bearings are interchangeable dimensionally with all heavy duty needle bearings. They are available with or without separable inner races.

Built especially for the tougher applications CAGEROL bearings feature many design and construction advantages. Put these new bearings and the McGill engineering department to work for you. Ask for recommendations.

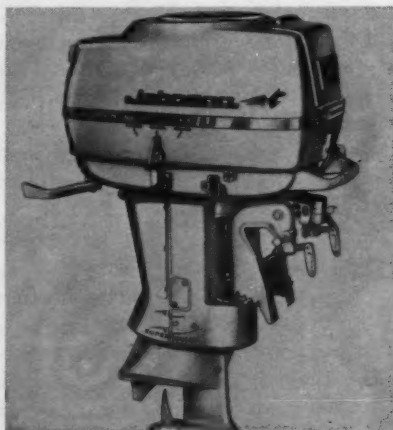
ROLLERS CROWNED TO PREVENT "END LOADING"

Rollers are crowned to relieve ends and prevent "end loading." Under load, stress is distributed uniformly throughout the length of the roller raceway. This prevents metal fatigue and premature bearing failure. Flat roller ends fully engage integral race shoulders for maximum possible support. Specially heat treated high carbon-chrome SAE 52100 steel insures long roller life.

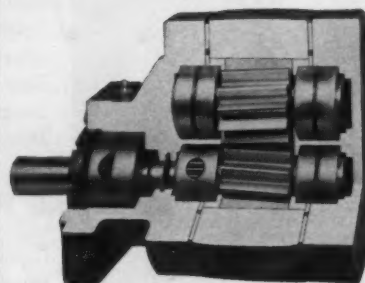


TAPERED RETAINER POCKETS GIVE BALANCED SUPPORT TO ROLLERS

Proper roller guidance is assured by tapered retainer pockets with retainer OD selected to fall outside the roller pitch circle. This establishes roller and crossbar contact on a concentric plane just below center. The McGill design insures balanced roller support and eliminates corner wear from edge loading of straight pocket walls where the retainer OD and pitch circle are coincident. The cage is supported by the outer race flanges.



CAGEROL bearings are being used by JOHNSON MOTORS in the upper journal positions of their 35 horsepower motors. Shown is the JOHNSON 35 h.p. SUPER SEA HORSE.



McGill CAGEROL bearings support the internal gears which rotate and operate under high pressure in COMMERCIAL SHEARING & STAMPING COMPANY oil hydraulic pumps and motors.



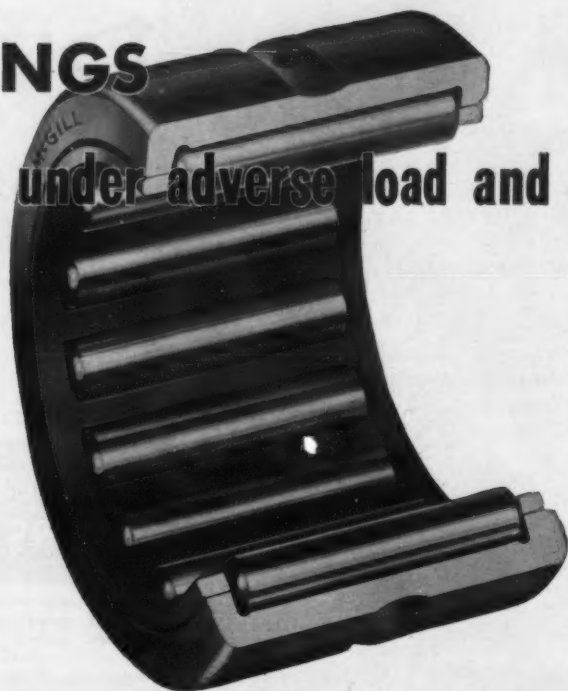
B & B INDUSTRIES selected CAGEROL bearings to increase roll pressures and reduce maintenance in their first anti-friction Calender Stack bearings as used on Saco-Lowell and Kitson Pickers.



WRITE TODAY FOR FREE MCGILL BEARING CATALOG No. 52-A for complete data on MCGILL GUIDEROL, CAMROL, MULTIROL and CAGEROL BEARINGS.

BEARINGS

bearings under adverse load and misalignment.



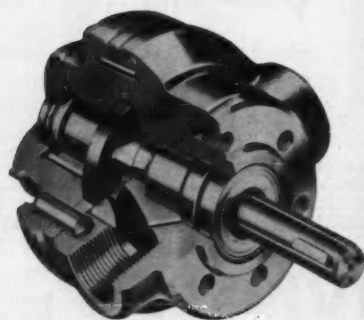
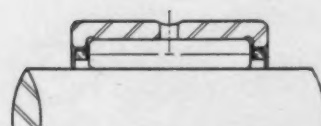
RETAINER BUILT FOR ACCURACY AND MINIMUM FRICTION

Simultaneously punched pockets in a continuous retainer assure the accuracy of race and roller alignment. The black ferrous oxide retainer finish absorbs and retains lubrication. The resulting low friction coefficient provides excellent performance at high speed.



INTEGRAL RACE FLANGES SUPPORT CAGE

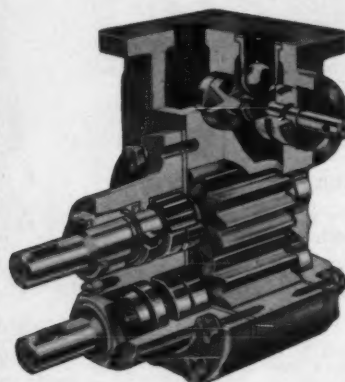
The SAE 52100 steel outer race has optimum hardness and surface finish for best performance. It is of one-piece, double-flanged construction. Flanges are integral with the race and support the cage around its circumference.



DOUBLE A PRODUCTS COMPANY has incorporated the advantages of the new CAGEROL bearing into their GEROTOR hydraulic pumps.



CAGEROL bearings have been selected for a variety of applications in HY-HOE back hoes manufactured by HYDRAULIC MACHINERY COMPANY.



Spur gear support requirements in ANTHONY COMPANY heavy duty hydraulic pumps are now being met by CAGEROL bearings.

engineered electrical products



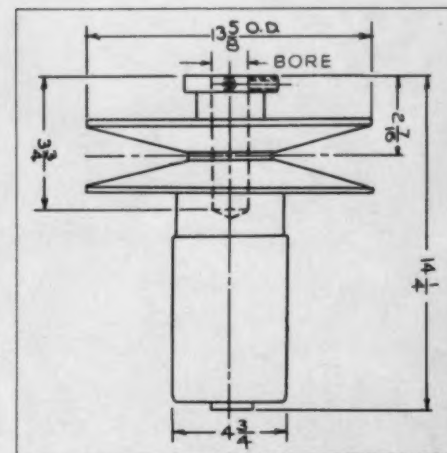
precision needle roller bearings

MULTIROL-GUIDEROL-CAMROL-CAGEROL

MCGILL MANUFACTURING CO., INC., Bearing Division
203 North Lafayette Street, Valparaiso, Indiana

Circle 69 on Reader-Service Card for more information

Variable Speed Pulleys 316



Rated at 20 to 25 hp at 1750 rpm and 10 to 15 hp at 1150 rpm, pulleys are available to provide instantly variable ratios up to 3:1. Known as Nos. 320 and 325, pulleys use a No. 27 (2 3/4-inch) top-width variable speed belt. They can be used with a number of NEMA frames, including sizes 215, 254, 254U, 256U, 284, 284U, 286U, 324, 324U, 326 and 364. Standard bores are 1 1/4, 1 3/8, 1 5/8 and 1 7/8 inches. Maximum pitch diameter is 13.1 inches and minimum is 4.35 inches. Overall dimensions are 14 1/4 inches long by 13 5/8 inches OD. Each pulley face is independently actuated by its own spring, assuring equal and simultaneous movement of both halves to maintain constant belt alignment. Pulleys are dynamically balanced to 0.02 oz-in for quiet operation and trouble-free service. Alemite fittings provide positive lubrication.

Lovejoy Flexible Coupling Co., 4854 W. Lake St., Chicago, Ill.



PRECISION-MADE SOLDERLESS TERMINALS

Immediate delivery on any type, any size . . . designed to fit most types of crimping tools

The progressive die-stamping pictured above is just one of the up-to-date production techniques that insure the high quality of Hollingsworth terminals. Fashioned from pure copper of the highest grade, all Hollingsworth terminals are meticulously manufactured to provide a completely reliable, vibration-proof connection.

Hollingsworth manufactures 16 types of solderless terminals as standard. They also custom-design solderless terminals for special applications. Whether your terminal requirements are ordinary or extraordinary, Hollingsworth can fill them to your complete satisfaction.

- Full 1/4" working shank
- Load capacity greater than that of the wire
- V-type grooves in throat grip wire securely
- Insulated types are color-coded according to size
- Beveled mouth for fast, easy wire insertion

Write for Hollingsworth catalog

HOLLINGSWORTH

COMPANY

Solderless Terminal Division
PHOENIXVILLE, PENNSYLVANIA

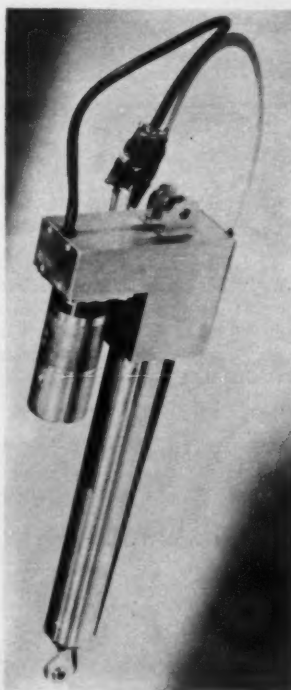
SA 2120

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MECHANICAL

Linear Actuator 317

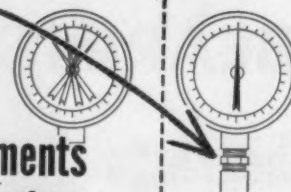
A d-c motor operates a precision ball screw and provides actuation of 500 lbs over a 6-inch stroke. Rate of travel is fixed at 10 inches per minute, but can be adjusted to meet other requirements. Maximum allowable tension or compression load is 2500 lbs. Actuator is de-



signed to meet military specifications for environment and radio noise shielding. Temperature range is -65 to 300F. Unit operates on 27 to 100v d-c; universal a-c/d-c operation is available. Actuator measures 14-7/16 inches long by 1 3/4 inches wide by 3 3/4 inches; weight is 3 lbs, 14 oz.

Globe Industries, Inc.,
1784 Stanley Ave., Dayton 4, Ohio.

NOW protect instruments from line pulsations and surges on refrigeration and automotive systems...



CHEMIQUIP'S NEW RS SNUBBERS

Designed for automotive, refrigeration or air conditioning applications, Chemiquip's newest snubber assures steady, accurate pressure readings . . . smooths out pressure impulses and fluctuations . . . protects pressure-sensitive instruments. Snubber element fabricated of Type 316 porous stainless steel membrane; unaffected by suspended oils in freon-type refrigerants . . . does not clog or plug.

Available in brass or steel in 1/4" and 1/2" npt, male or female by 1/4", 5/16" and 3/8" flared and compression tubing.

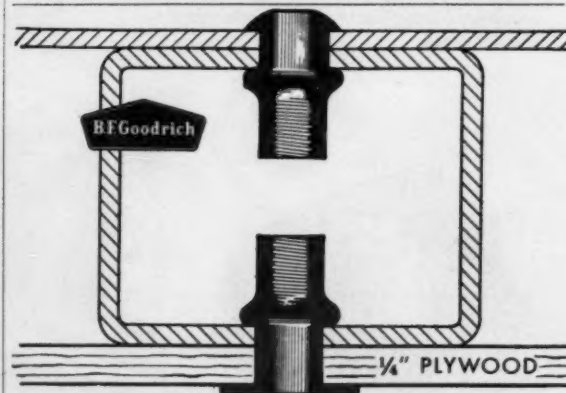
Write TODAY for detailed bulletin J-74

CHEMIQUIP CO.



36 East 10th St., New York 3
GRamercy 7-3772

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Use RIVNUTS® to fasten plywood to steel

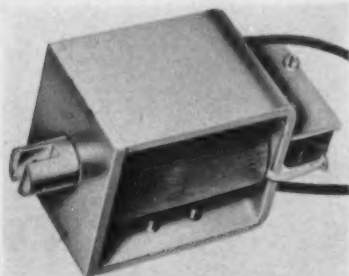
Fastening is clean and quick with RIVNUTS . . . the only one-piece blind rivets with internal threads. RIVNUTS are installed in tubular section, act as high strength blind rivets. Also serve as nutplates if attachments with screws or bolts are desired. For full information write for RIVNUT Design Data, Dept. DN-2, B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Akron, Ohio.

B.F. Goodrich Rivnuts

Circle 72 on Reader-Service Card for more information

DESIGN NEWS—FEBRUARY 13, 1961

Low Current Drain Solenoids 318



High-power solenoids, for direct-current applications, are rated for continuous-duty service. This series, designated type "PS", derives its high-force characteristic by incorporating a coil having two windings. One is a high-surge pull-in winding which starts solenoid plunger in motion. The second is a low-drain winding for holding plunger in a seated position. Windings are switched automatically by motion of plunger.

Anderson Controls, Inc., 9959 Pacific Ave., Franklin Park, Ill.

Size 11 Synchro 319

Typical applications of the model 1085 synchro receiver include fuel flow instruments, hydraulic pressure indicators and torque indicators. The unit may also be servo driven for positioning potentiometers and servo instruments. Nominal operating specifications include an input of 26v at 400 cps and 0.4w power consumption. Output is 11.8v maximum and repeater positioning error is not more than 30 minutes. A 115v model is also available. The unit is equipped with ABEC Class 7 ball bearings at both ends of rotor shaft. Approximate overall length, exclusive of shaft, is 1.6 inches, and weight is 2 3/4 oz.

Model Engineering & Mfg. Corp., Courter Products Div., 50 Frederick St., Huntington, Ind.



Circle 73 on Reader-Service Card



One Lamb FHP motor...up to 100,000 carbon copies mass-produced to exacting specifications

From a prototype . . . hundreds OR thousands of motors with absolute uniformity. Each and every motor produced has the same, discriminating, "built-in" perfection that you can expect with Lamb® manufacturing. This precise mechanical and dimensional uniformity of motor as an integral component for your powered product is extremely important . . . and Lamb makes sure you get it!

If you have a special motor problem . . . here's what you can expect from Lamb! Into the design of a Lamb motor goes years of experience in powering components for aircraft, domestic and industrial products. Out of the design comes a personalized motor that's dependable, smooth and efficient.

Cost-wise you're way ahead, because Lamb Motors are mass-produced at the most favorable cost.

Write today for descriptive folder. Or ask to have a District Engineer call and set up a personalized "Motor Conference".

THE LAMB ELECTRIC COMPANY • Kent, Ohio

A Division of American Machine and Metals, Inc.

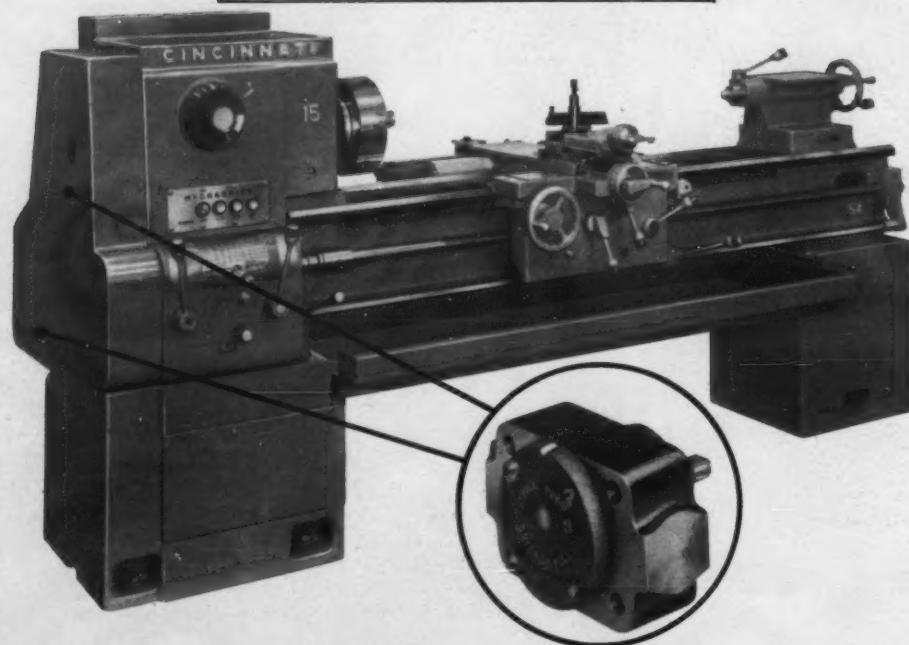
In Canada: Lamb Electric—Division of Sangamo Company, Ltd.
Leaside, Ontario

Lamb Electric

SPECIAL APPLICATION
FRACTIONAL HORSEPOWER **MOTORS**

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Another pump problem . . . solved by TUTHILL



TUTHILL PUMPS For Hydraulics, Lubrication in New Cincinnati Hydrashift Lathes

Cincinnati's new Hydrashift lathes use hydraulic power instead of muscle for spindle speed shifting. Entirely new from headstock to tailstock, these dependable units reflect in every way the quality and reliability long associated with this leading machine tool manufacturer.

Cincinnati selected Tuthill pumps for two vital assignments . . . to provide hydraulic power for Hydrashift preselective speed shifting . . . and for positive pressure lubrication of the entire unit. Minor modifications of a standard Tuthill cartridge pump, Series RFD, enable it to meet the requirements of both applications . . . providing interchangeability and allowing incorporation of both units with the greatest possible ease on Cincinnati's assembly line.

Wide Selection Available From Stock

Tuthill's versatile and dependable cartridge pumps have been used for hundreds of applications . . . both as OEM components and for

maintenance. Their compactness solves design problems . . . for example the Model RFD above measures only 4¼" by 2½" by 3½" including shaft. Moderate prices and immediate availability from stock minimize inventory problems, result in significant savings.

Cartridge pumps can be supplied for capacities from 55 to 360 gph at 1800 rpm. They are available with or without Tuthill's special reversing feature which allows them to be driven from reversing shaft or for nondirectional service. They may be supplied with internal or external porting . . . or with variations of both. Three different standard shaft modifications are offered and many more are available.

Send today for Catalog 100 which gives complete details . . . or send information on your particular application so Tuthill's engineers can indicate ways in which a Tuthill pump can save you money.

Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.



TUTHILL PUMP COMPANY

943 East 95th Street, Chicago 19, Illinois

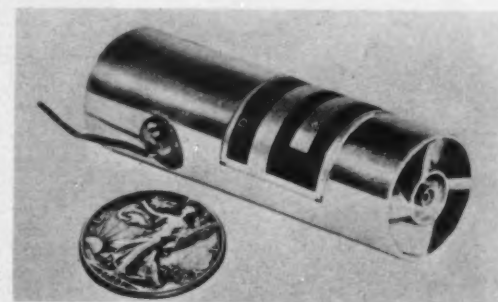


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MECHANICAL

Miniature Blower

323

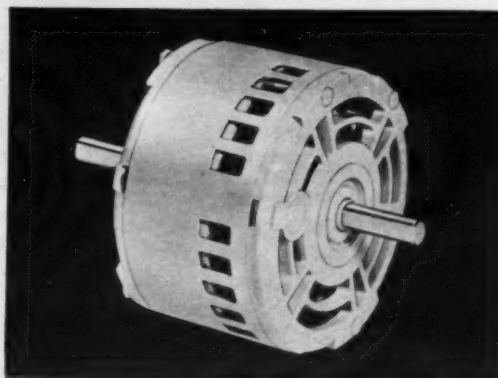


A miniature d-c blower, smaller in diameter than a half-dollar, is designed to move 10 cfm of air against 0.3 inch H₂O back-pressure. This tube axial blower is 1½ inches in diameter by 3¼ inches long and operates on 27v d-c. Lower voltages may be used with different motor windings. Unit weighs 3.5 oz. Device pictured utilizes the type VS motor and is typically used for spot cooling of critical components in circuit.

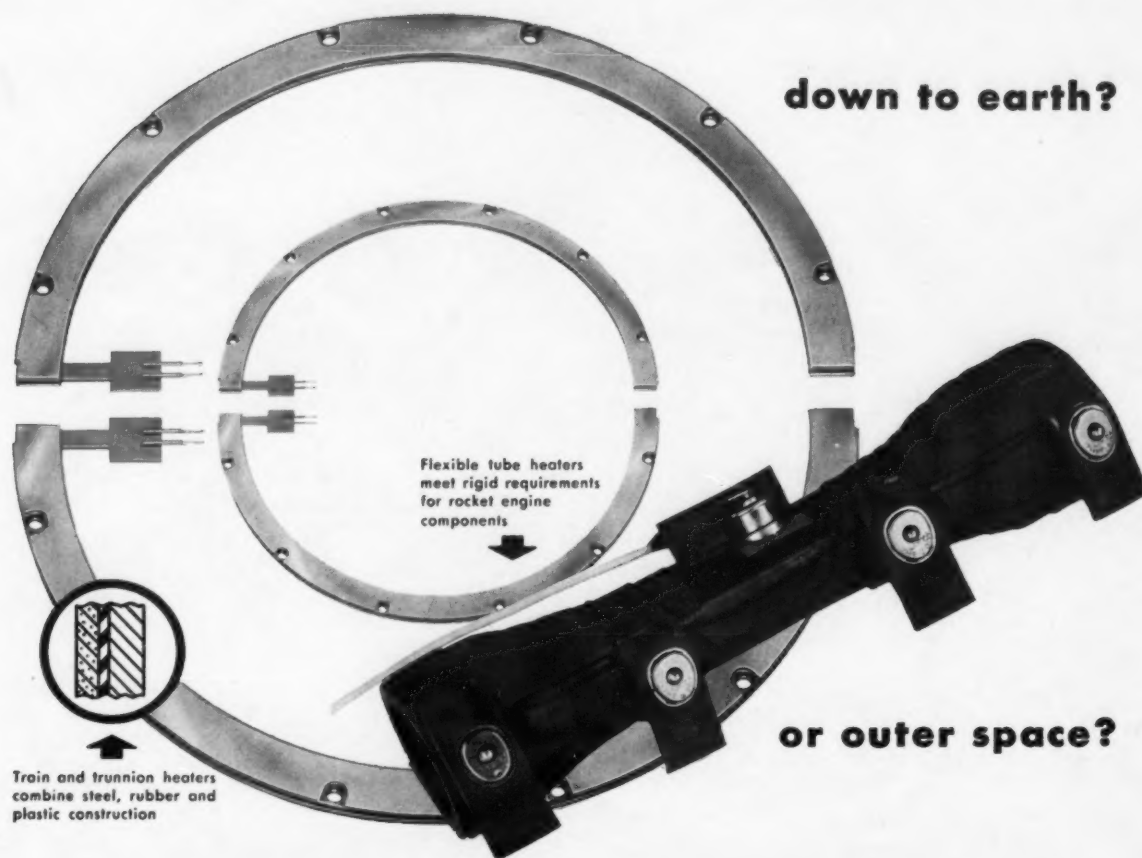
Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

Fractional HP Motors

324



Split capacitor fhp motors are capable of high efficiency and quiet operation even where heat is a problem. Available in ratings from 1/15 to ½ hp at 1050 rpm (115v, 60 cycles), this series can be wound also for 208 or 230v operation at 50 or 60 cycles. Features include full screw, centrifugally-cast rotors with distributed wound stators; large ½-inch bearings; moisture-proof slot and cell insulators; and precision-ground and polished shafts. All units are capable of meeting UL and CSA application tests. Leece-Neville Co., 989 Athens St., Gainesville, Ga.



SAFEWAY Heat Elements apply engineering imagination to all defrosting, de-icing and heating problems

Unusual and intricate *cold-control* problems frequently find their way to us. The circular heat elements shown above are components of vital ground support equipment. Exacting specifications called for the "sandwiching" of a continuous, circular heating element between two rings of different materials. The actual heating element is encased in silicone rubber and then bonded under controlled heat and pressure to two external rings: one of *silicone-resin impregnated fiberglass* and the other of *stainless steel*. The completed unit must withstand lengthy soak-testing in a salt water solution. Outside diameters of the train and trunnion rings are 56 7/8" and 29 3/4", respectively.

The flexible tube heater illustrated is another

successful solution to a complex flight propulsion system heating problem. In this instance, custom-made flexible tube heaters have resistance wire molded in silicone rubber. Result—uniformly *dependable* heat is provided for rocket engine components.

MEETS THE MOST SPECIALIZED REQUIREMENTS

Safeway's long-term military and industrial experience backs up the production of thoroughly reliable heating, de-frosting and de-icing units—*woven, molded or strung*—for scores of different applications. So, if *cold-control*—of any description—is on your "problem list", write or phone us. Chances are excellent we can help you.

Write today for our fact-filled brochure, describing the wide range of materials, specifications and application possibilities. Safeway engineers will gladly analyze your requirements and submit practical recommendations.

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Circle 76 for more information on Cutler-Hammer Products Shown inside



**Now! Make any pushbutton station
you want with new, completely versatile
Cutler-Hammer oiltight pushbuttons**

*Choose from a complete line of operators,
get greater circuit flexibility than with any other make*

To meet today's need for a broad range of oiltight pushbuttons, Cutler-Hammer gives you a new versatile line.

You can get these rugged proved push-buttons in one hole or base mounting, six bright colors. More than thirty different circuit arrangements are available plus hundreds of varieties of stations in standard arrangements of up to 25 elements. And you can get up to 8 circuits on one pushbutton. The flexible oil resistant diaphragm behind the button is designed to stay soft and pliable permanently.

With Cutler-Hammer pushbuttons you can get more control in less space, too,

because they use 40% less behind the panel space than the next smallest unit.

Get all the facts by sending for the colorful brochure, "MASTER DESIGN" which tells you all about the Cutler-Hammer line. Ask for Pub. LO-104.

What's new at Cutler-Hammer?

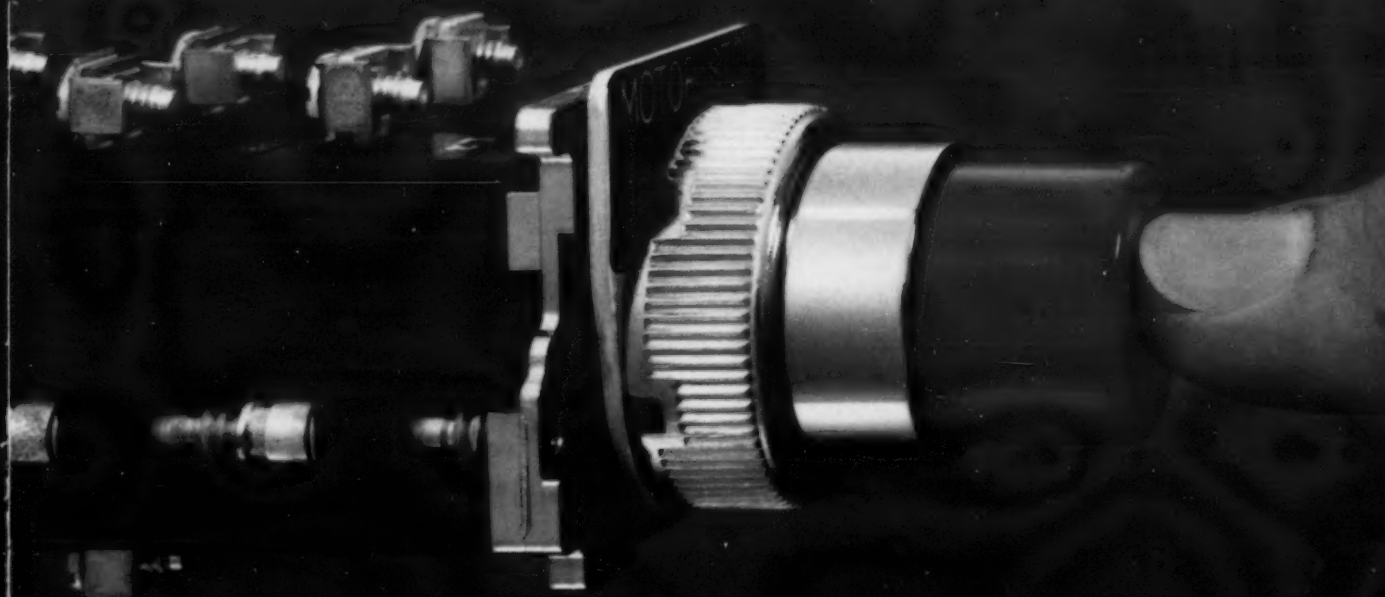
You can see the newness in the products coming from Cutler-Hammer, like the new smaller pushbuttons; in the new manufacturing facilities; in the new engineering ideas. All to give you better service today and in the future. Contact the nearest Cutler-Hammer sales office or your Cutler-Hammer distributor.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.





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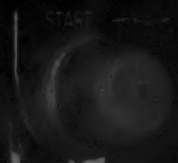
RESISTOR LIGHT



KEY



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PRETEST LIGHT

HANDY & HARMAN SILVER BRAZING Permits Manufacturer to Guarantee Underwater Air Regulator For Life



Perhaps the most vital component of a skin diver's equipment, this Viking Air Regulator, manufactured by Christensen Tool & Engineering Company, Norwalk, Connecticut, is structurally guaranteed for life. It must, under all conditions, be absolutely leaktight. The manufacturer's guarantee is a relatively recent achievement—through the high-strength help of silver alloy brazing with Handy & Harman EASY-FLO 45 and HANDY FLUX.

Over and above the unreserved dependability of brazed joints, the brazing method itself has saved the company considerable time, money and material in the production of the Viking Air Regulator. Brazing's simplicity is interestingly illustrated in this case by this company's require-

ment that assemblers and testers of the Viking must be skin divers themselves.

Almost invariably, silver brazing effects economies and brings advantages to whatever part, product or assembly it is applied. True, air regulators are few and far between, but the point is that they are *metal products, made of a number of different metal components.*

And that's the phrase that covers brazing's great adaptability. To give you a good idea of how you can put brazing to work, we'd like to send you Bulletin 20—it covers the basics of brazing and it may very easily solve your metal-joining problems. Handy & Harman, 82 Fulton Street, New York 38, N. Y.

**Here, in "serial" form is how the guarantee
is "brazed" into the Viking:**



1. TANK HOUSING—Initially, this component was mechanically joined and made "airtight" by means of sealants. Now, brazing eliminates 8 holes, 4 tapping operations, 4 screws and 3 assembly operations.



2. FORK ASSEMBLY—There are five separate brazed joints, done with hand torch and hand-fed wire. Brazing eliminates one tapped hole, a lock washer and a spacer, plus the fact that positive alignment is now guaranteed.



5. Shown here are the finished Viking components before and after assembling.
—Brazing by Specialty Brazing Laboratories, Riverside, Connecticut.



3. YOKE—This is assembled from stampings instead of castings, which were previously used. With brazing, no secondary finishing operations are required. Further, the part is stronger and lighter, and savings on material and labor on this component alone add up to 28%.



4. PISTON—This is the most important single element of the Viking. It regulates flow of oxygen from cylinder to mouthpiece; from 300 lbs. pressure to normal breathing. Without brazing, this part could not be made.

Your No. 1 Source of Supply and Authority on Brazing Alloys



HANDY & HARMAN
General Offices: 82 Fulton St., New York 38, N. Y.
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Circle 76 for more information on Cutler-Hammer Products Shown inside

Stainless Socket Fastener

325

A high-strength, austenitic stainless-steel fastener with minimum rated tensile strength of 125,000 psi is designed to meet the current need for high corrosion-resistant socket screws with high strength ratings. Use of the "pHd" (1960 series) head dimensions provides increased bearing areas and results in uniform bearing stresses in all sizes. Forged heads are burr-free. Rolled threads have a rounded radius (SPS Hi Life) in root to reduce stress concentrations and provide good fatigue resistance. Operating range is —300 to 800F. The type 304 stainless



provides good corrosion resistance and low magnetic permeability of under 1.2. Room-temperature ratings are: 75,000 psi shear strength and a tension-tension fatigue endurance limit of 40,000 psi. At 800F, with an initial stress of 65,000 psi, residual stress after 50 hrs was found by stress relaxation testing to be 55,000 psi. The high corrosion-resistant screw is made in sizes 8 through 3/8-inch dia in both coarse and fine thread series.

Standard Pressed Steel Co., Jenkintown, Pa.

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Only K&E offers you all the film-based media for your drafting and reproduction needs, and they're all *working* products, designed to permit additions or deletions. The same engineered drafting surface throughout enables you to standardize on drafting techniques, and the same base throughout means constant behavior characteristics under exposure to light, heat, moisture, etc.

1. HERCULENE® — the unchallenged leader among drafting films, with better than ever working properties for pencil, ink, and typing. Now with a choice of specialized writing mates: *Duralar* plastic pencils render tracings that are completely washable in soap and water... new *Ruwe* pencils have all the fine "feel" of graphite, yet resist smudging better than graphite on regular paper.

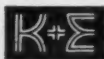
2. PHOTACT® — the photographic second original *on film* that can be processed with regular *paper* developer. Image lines can be *manually* erased, too (no eradicators needed). Underneath — an excellent drafting surface for changes or additions in pencil, ink or typing. Available in three film types: Contact, Direct Positive, and Projection.

3. DUPRO® — for ink-like second originals that can serve as working copies. Image lines are smudge-proof, with appearance and permanence of photography, yet are easily removed with soft vinyl eraser. For additions or changes in pencil, ink or typing: a perfectly balanced drafting surface underneath. Another advantage: wash-off emulsion permits processing in room light — *no darkroom needed*.

4. HELIOS® — for intermediates of exceptional ruggedness, produced easily, quickly, and at *low cost* by the standard dry diazo process. Mechanical erasure removes image lines (no eradicators needed); engineered drafting surface on the reverse side. Unsurpassed line density and background clarity — black line or sepia.

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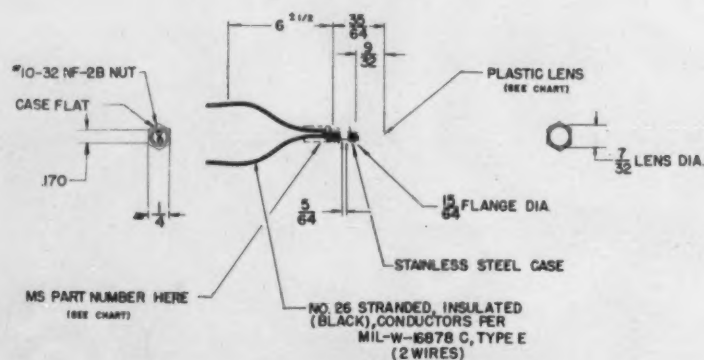
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ELECTRICAL

High-Impact Indicator Light

326

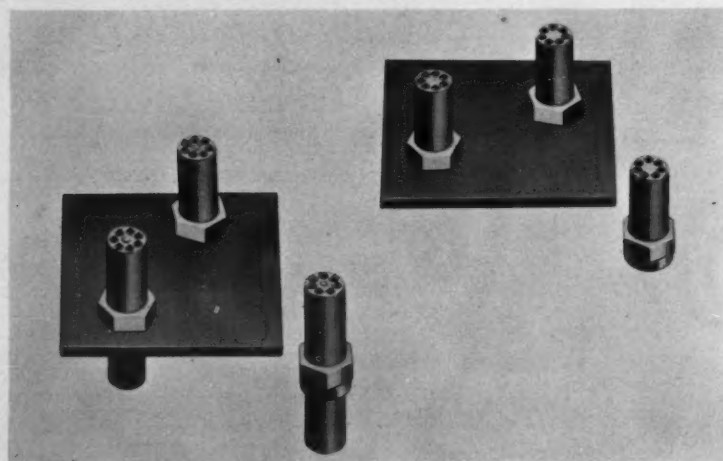


A moisture-proof subminiature indicator light meets high-impact shock tests of MIL-S-901B. Surpassing MIL-L-6723 requirements, the L20046 is rated for a minimum of 60,000 hrs operation at 5v and a minimum of 6000 hrs at 6.3v. Indicator features completely sealed construction, stainless-steel case and various lens colors.

Control Switch Div. of Controls Co. of America, Folcroft, Pa.

Miniature Feedthrough Insulator

328



Insulated feedthrough and standoff component connectors offer high tie-point density in small size. The connector is only 0.25 inch high off board and only 0.190 inch OD holding 7 microminiature sockets equally spaced on a 0.120-inch dia circle. Unit accepts wires of 0.010 to 0.022-inch dia. Both standoff and feedthrough connectors are fastened

to board by simple staking methods. Connectors can be mounted on fixed or known grid patterns, permitting insertion of components automatically. Connector section is insulated from case, so units can be mounted on metal chassis or base plates to make up sub-modules.

Omega Precision, Inc., 757 N. Coney Ave., Azusa, Calif.

Mylar-Epoxy Capacitors

327

A typical 0.01 MF, miniature-size, mylar-epoxy dipped capacitor measures 0.525 inch wide and is only 0.225 inch thick. High temperature stability results in a capacitance change of only 1.5 percent at 85C. Designated type MCA, unit operates from -55 to 100C without derating. Capacitor may be operated to 125C with 50-percent voltage derating. Power factor is less than 1 percent at 1 kc and 25C. Insulation resistance is 75,000 megohms minimum at 100v d-c, 25C, 2 minutes. Epoxy coating protects against solder damage. Unit is available in a range of values from 0.01 to 0.33 MMF. Plug-in leads can be supplied either straight or formed, to meet specific requirements.

Hopkins Engineering Co., 12900 Foothill Blvd., San Fernando, Calif.

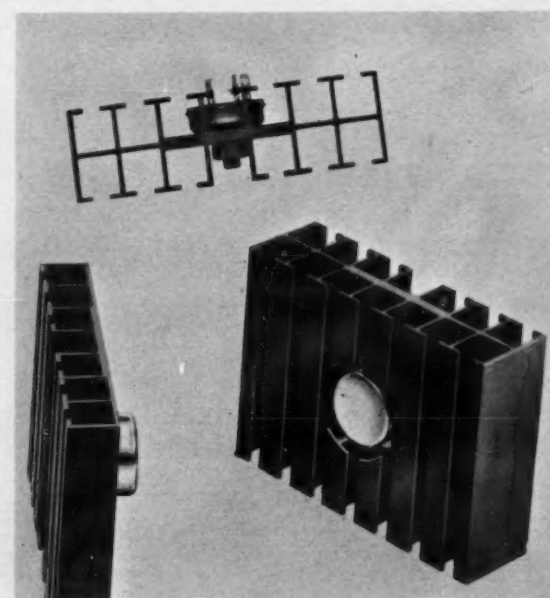


Transistor Heat Sinks

329

A natural convection heat sink increases transistor performance by offering a thermal resistance of only 1.3C/w. Model 2502 measures 1 1/4 inches wide by 3 inches high by 1.281 inches deep. A 1 1/4 inch dia recess is standard and provides easy mounting of all types of semiconductor packaging including the TO-3 (diamond), TO-6 (door knob), TO-5 and TO-36 types. Model 2501, with fins on one side and measuring 4 3/8 by 0.687 inches, provides about the same thermal resistance (2C/w) in conventional designs in less than half the space. By using insulating washers, the heat sink package can be electrically isolated, thus eliminating the need for mica washers.

Astro Dynamics, Inc., 200 Sixth St., Cambridge 42, Mass.



Bind Wires Fast... At Low Cost with

Heli-Tube®

HELI-TUBE is a spirally-cut plastic tubing. Its shape-retaining characteristics make it ideal for binding electrical wires into cables. Wraps on like tape; holds wires together tightly; individual wires, taps, or lead-offs can be led out at any point. Earns cost back in time and labor-saving.

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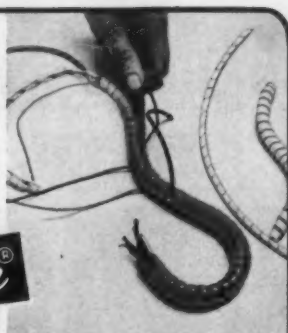
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- Type 275°F (High-temperature)

Each form in three diameters:

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• So Safe! Crystal clear "See-Thru" Plastic Cap reveals the blade. No mistaking it for anything but a knife when carried with other capped instruments.

• Always Convenient! Just clip it to your pocket and carry it with you everywhere. For immediate improvement in efficiency, accuracy and safety switch to X-acto!

(Here's an idea! The X-acto PenKnife can be imprinted. It makes an excellent business gift. Complete details, with quantity prices, sent upon request.)

No. 3-ST
Actual
Size



- No. 10 — for small, fine general cutting.
- No. 11 — for fine angle cutting, deep cuts, narrow slots.
- No. 18 — for small holes, notches, stencils — in thin materials.

Open and ready for action! When not in use, replace the cap (like a pen) and clip it to your pocket... always handy.

Sample Offer

HANDICRAFT TOOLS, Inc.
Div. of X-acto, Inc.
48-410 Van Dam Street
Long Island City 1, N. Y.

Enclosed is \$1.00. Please send me a PenKnife with the number... (specify #10, #11 or #18 blade) blade and free illustrated catalog of X-acto precision knives, blades, and tools.

Name _____
Company _____
Address _____
City _____ Zone _____ State _____

Circle 84 on Reader-Service Card for more information

Circle 79 on Reader-Service Card for more information

Circle 80 on Reader-Service Card for more information

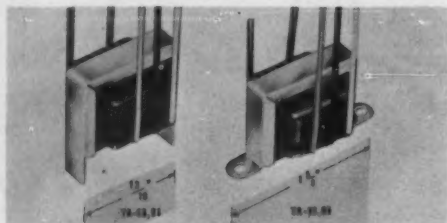
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Circle 83 on Reader-Service Card for more information

ELECTRICAL

Transistor Audio Transformer

330

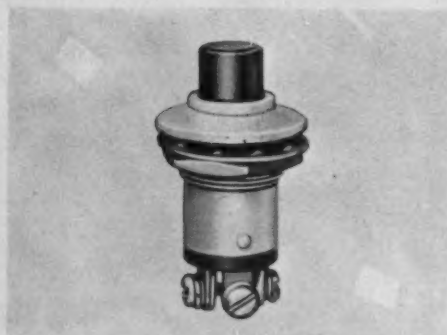


TA-53 is a miniature interstage transformer with a primary impedance of 5000 ohms CT and a secondary impedance of 45,000 ohms. TA-54 is an interstage unit with a primary impedance of 20,000 ohms and a secondary impedance of 800 ohms CT. Both are rated at 0.15w and measure 13/16 by 5/8 by 11/16 inch. Model TA-52, an interstage transformer, has both primary and secondary impedance of 500 ohms CT. TA-55, an input transformer, has primary impedance of 500,000 ohms, secondary impedance of 200 ohms CT. Both are miniature units rated at 0.3w and measure 1 1/8 by 13/16 by 3/4 inch.

Chicago Standard Transformer Corp.,
3501 W. Addison St., Chicago 18, Ill.

Terminal Switch

331



The C124P3 control switch is a normally-operated device rated 10 amps at 28v d-c resistive, 5 amps at 28v d-c inductive, 3 amps at 28v d-c lamp or 15 (0.75 P. F.) at 120 a-c. Switch requires only 5/8-inch mounting hole, features aluminum casing and adapter, 25,000 operations minimum life at rated load, and requires 4 lb operating pressure.

Control Switch Div., Controls Co. of America, Chicago, Ill.

Whether you choose by specification,
price or both...

There's a Honeywell to fit your

As low as \$50.00

☐ For precise control at low cost—R7086—R7087

Temperature controllers for use wherever precision temperature control must be maintained. Ranges from -150° to +3000° F. are possible. (R7086 uses thermo-couple, R7087 use resistance bulb.)

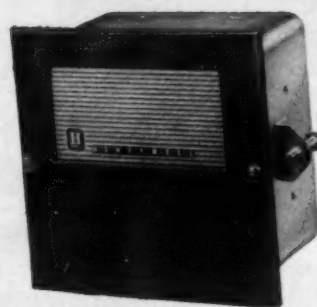
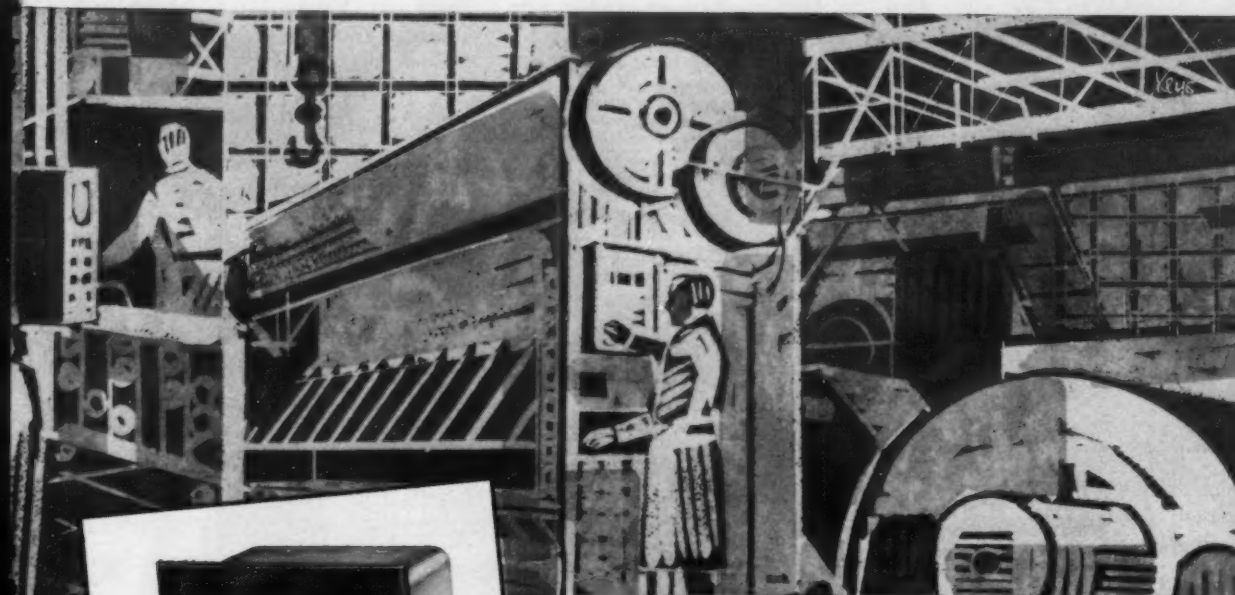
R7087, \$120.00

\$84.00

☐ For accurate control with indication, at low cost

T654A indicates and controls temperatures on an evenly graduated scale accurate within 1% of scale range. This switch can control an Actionator*, motor, relay, contactor or other device. Completely compensates for ambient temperature changes.

temperature or pressure control exact needs!



As low as \$49.50

☐ For reliable control at
minimum cost **VERSA-TRAN**

This inexpensive controller is completely transistorized. Needs no tubes, no warm-ups . . . gives instant reaction. Works with sensors that can be thermistors, probes, resistance bulbs, pressure transducers or humidity elements. Available in various temperature, humidity and pressure ranges.

Standard models as low as \$39.50

Check these other models in the complete Honeywell line of temperature and pressure controls



P444

For industrial applications that call for independent high-pressure and low-pressure settings and switching action. Adaptable for surface or flush mounting.



T444

For a wide variety of industrial applications that require independent high-temperature and low-temperature settings and switching action.



P428

For general industrial applications requiring the control or limiting of relatively high pressures. Models are made with explosion-proof case for installation in hazardous locations.



T667

Designed for use as a remote-bulb temperature controller. SPDT switching provides temperature control in heating, cooling, or heating-cooling commercial and/or industrial applications.

Honeywell



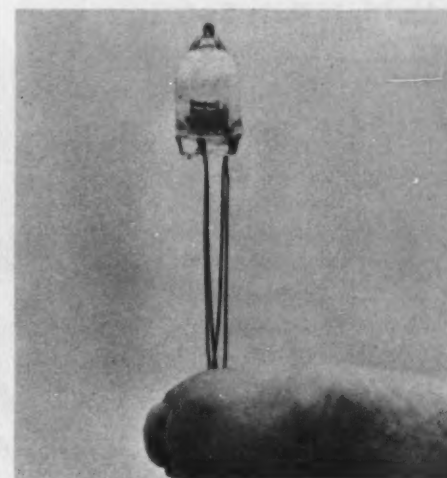
First in Control

*Trademark

SINCE 1885

Subminiature Overload Protector

332

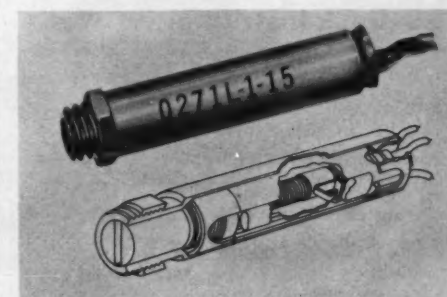


The WC-28 cold-cathode trigger tube is used wherever a high pulse current of several hundred amps and short delay time of a few microsecs are required. Tube is rated from 350 to 300v d-c on the anode, with a hold-off voltage of 3500v d-c. Peak cathode is from 10 to 1000 amps. Grid pulse amplitude is 230v minimum for a duration of a maximum of 10 microsecs.

Electronic Industries, Inc., 18 Marshall St., South Norwalk, Conn.

Trimming Potentiometer 333

0.250-inch dia, 1.325 inches long



Power rating 1/4 w at 50C, derate to 0 at 125C.

Temperature range -55 to 125C.

Resistance range 3 to 17 ohms.

Humidity seal MIL-E-5272, Proc. 1.

Terminals leads or solder lugs.

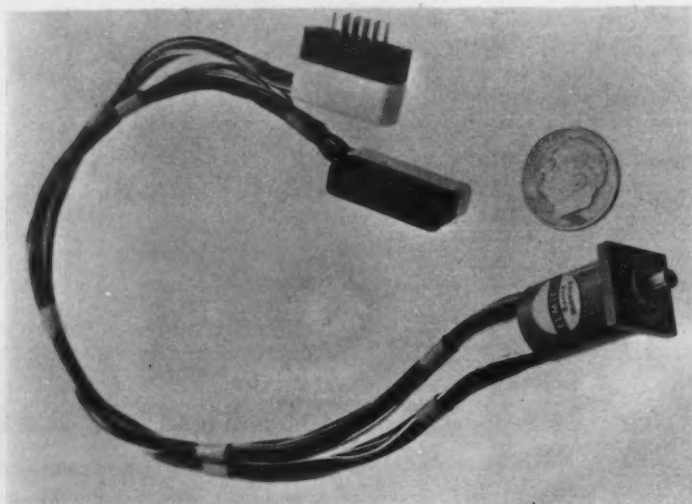
Case aluminum.

CON-ELCO Div. of Edcliff Instruments,
1711 S. Mountain Ave., Monrovia, Calif.

Circle 85 on Reader-Service Card for more information

Multiple Pole Switch

334



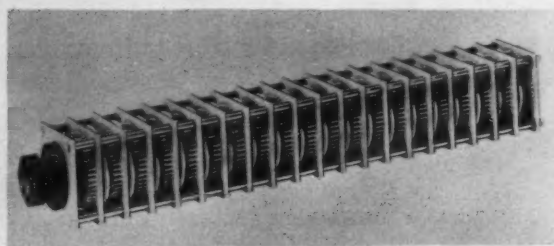
This microminiature rotary switch has 20 isolated circuits which make or break simultaneously when shaft is rotated. Switching can be accomplished either by oscillating or by rotating shaft in either direction. Circuits are rated at 200 ma, 28v (resistive load) with an expected life of 1 million cycles. Switch can be operated under severe shock and vibration. Temperature range is -65 to 105°C . Available in a variety of switching configurations, the unit measures 1.10 inches overall length by 9/16-inch dia. Weight is 1/5 oz.

Electronic Micromolding Co., 2219 Main St., Santa Monica, Calif.

20-Deck Instrument Switch

336

Contacts, collector rings and one-piece brushes of this 20-deck instrument switch are all fine silver, eliminating effects of oxides and sulphides and producing no thermal voltages. By using a square, floating, stainless-steel shaft and by employment of a pressure-equalizing brush design, torsion and drag are reduced. Vertical rise detents produce positive action with equal torque in both directions and a captive rotor design with all decks integrated and self-aligning. This allows any deck to be serviced or replaced with only a socket wrench and



without disturbing wiring to other decks. Contact resistance is a low 1.3 ± 0.2 milliohms.

Langevin Div. of Sonotec Inc., 503 S. Grand Ave., Santa Ana, Calif.

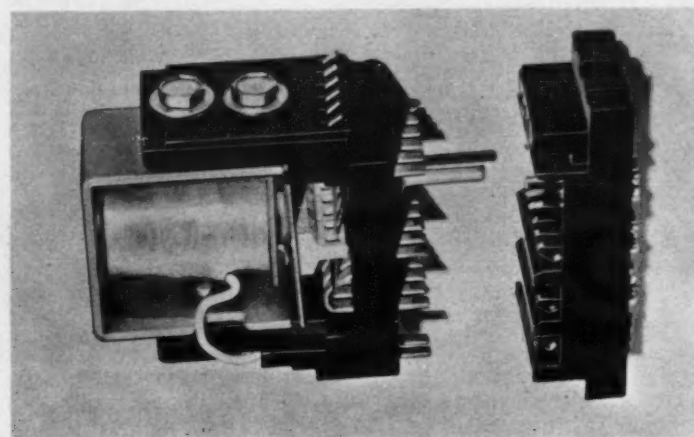
Plug-In Relay

335

A wire-contact relay, available in 4, 6 and 12 pole plug-in, may be adapted to rack mounted circuitry where space is at a premium and where long life, fast action and minimum maintenance are requisite. Contact arms are double wire (bifurcated) silver-alloy springs that are removable by hand without tools. Contact rating of each form "C" arm is 1-amp resistive at 25v d-c or 115v a-c for 1 million operations life; 0.5 amp for 3 million life; and 3 amps for 200 million

life where load is not switched. Modular constructed relay measures $1\frac{1}{2}$ inches high by $1\frac{3}{4}$ inches deep and $\frac{5}{8}$, $\frac{7}{8}$ and $1\frac{3}{4}$ inches wide for 4, 6 and 12 pole versions respectively. Relays are obtainable in 48 and 115v d-c coils to operate in $4\frac{1}{2}$ millisecs and release in 3 millisecs. Special voltages also can be obtained.

Wheelock Signals, Inc., 273 Branchport Ave., Long Branch, N. J.



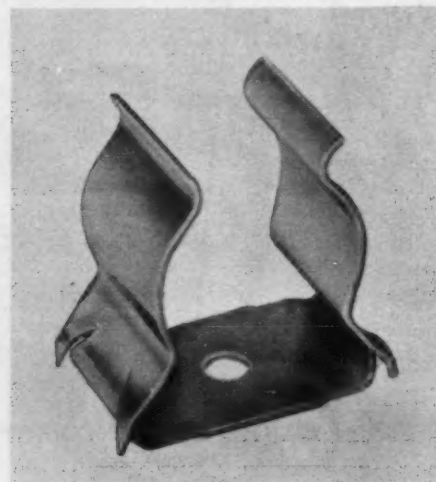
Component Clip

337

Integral projections on the bottom of this clip eliminate twisting where a single attachment point is required. The clip meets

all requirements of holding components against shock and vibration. Their holding power increases as shock and vibration increase, measured by force required to remove the component. Manufactured from spring steel and available in various plates and finishes, 100-223 will withstand 100 insertion-withdrawals of a slug $1/32$ -inch larger than nominal diameter, without metal fatigue. Clips are available in 9 component diameter sizes.

Atlee Corp., Atlas Div., 47 Prospect St., Woburn, Mass.



SIMPLIFY DESIGN PROBLEMS WITH



PRIOR CONVENTIONAL AXLES

Available in all standard sizes up to 2" and in custom sizes on special order. Singles and tandems, straight and drop axles. Complete running gear assemblies. Let us help you solve your running gear design problems. For further information, write

PRIOR PRODUCTS, INC. P. O. BOX 7808 • DALLAS, TEXAS

Circle 86 on Reader-Service Card for more information

CURTIS "M" Series Terminal Blocks for applications requiring UL approval

Curtis "M" Series Terminal Blocks are offered in two series, Types "M" and "MT" (with marking tag) rated at 300 V., 15 amps. and Types "MA" and "MAT" (with marking tag) rated at 300 V., 25 amps. Both types are available with from one to 24 terminals assembled in a plated steel mounting channel.

Altho requirements of UL Standards differ, Types "MA" and "MAT" are designed to meet specifications for wire terminations made in the field. Equipped with No. 8 screws, .051" bars and $\frac{1}{16}$ " creepage distance. Flexibility of built up construction permits greater spacing at low cost.

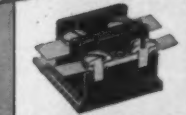
Types "M" and "MT", equipped with No. 6 screws, and rated at 300 V., 15 amps. are usually acceptable for factory made connections, and provide equal quality but lower cost.

Write for Bulletins DS-119 and DS-127.

CURTIS DEVELOPMENT & MFG. CO.

3220 North 33rd Street Milwaukee 16, Wisconsin

Curtis Terminal Blocks Make Better Connections Economically—Quickly. A Type for every Purpose.



Sectional View of Series "MAT" showing convenient marking tags and heavy .051" terminal bars. Note that molding completely insulates screws from base channel.



Circle 87 on Reader-Service Card for more information

MAYLINE



DESK-O-MATIC

Tilting Action Completely Balanced!

Adjustable springs on the tilting quadrants of the Mayline Desk-O-Matic and May-O-Matic drafting tables give the draftsman a constant smooth change in angle position of the drafting top, despite any accessories that might have been added to the top edge.

For additional information on this important top tilt control factor, inquire of your local dealer or write to factory. All inquiries answered promptly.

MAYLINE CO., INC.

529 No. Commerce St.

Sheboygan, Wisconsin



MAY-O-MATIC "E" COMBINATION

MAYLINE

Circle 88 on Reader-Service Card for more information

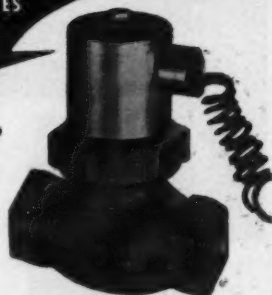
Check these prices on Gould Type M

Solenoid Valves

TYPICAL USER NET PRICES
F. O. B. FACTORY

SIZE	1 to 5	100 to 499
$\frac{1}{8}$ "	\$15.40	\$11.15
$\frac{3}{16}$ "	18.50	13.60
$\frac{1}{4}$ "	24.25	18.50
$\frac{1}{2}$ "	48.00	42.40

2-Way • General Service
Packless • Normally Closed



Sizes $\frac{1}{8}$ " to 3" • Temperatures to 250° • Pressures to 400 psi • Molded epoxy resin water-proof coils • Unbreakable piston rings • No damaging hammer • Easy-off "O" ring bonnet construction in sizes $\frac{3}{16}$ " thru $\frac{1}{4}$ " • High temp coils and explosion proof housings available. Immediate delivery. Ask for Bulletin 600-M.

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B—Adjustable flow control, adjustable cushioning control to reduce shock, manual opening. **HV**—Four independent controls—opening, closing, flow, manual opening. **G**—Stainless, fractional ports, pressures to 1,000 psi. **GX**—All 316 stainless, fractional ports. **K**—Stainless, $\frac{1}{8}$ " to 2". **MDW**—Direct acting. NOTE: Special assemblies for exacting requirements.

J. D. GOULD CO. • 4707 MASSACHUSETTS AVE. • INDIANAPOLIS 14, IND.

GOULD SOLENOID VALVES



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Patented construction provides double sealing action. Excellent for high pressure and high vacuum applications. Pressure ratings 2,000# to 6,000#. Screwed or socket weld ends, for pipe sizes to 2". Send for catalog today.

THE SPECIAL SCREW PRODUCTS COMPANY
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• High-speed roll forming techniques which incorporate punching, notching, embossing or other secondary operations can drastically cut your metal shapes costs. The shape you need may already be in stock at Roll Formed. Check Roll Formed Bulletin 760 for existing shapes and see how Roll Formed's skills can help you cut costs and give you deliveries keyed to your production schedules.

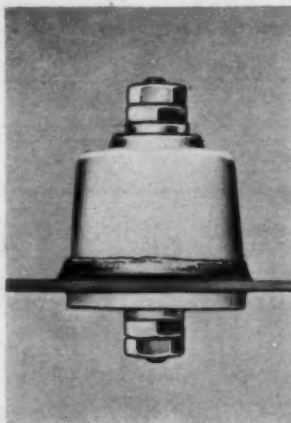


MAIN OFFICE AND PLANT
3763 OAKWOOD AVE., YOUNGSTOWN, OHIO
 Circle 92 on Reader-Service Card for more information

ELECTRICAL

Feedthrough Insulator 338

A silver-based "Teflon" feed-through insulator withstands severe mechanical and thermal shock, vibration, extremes in temperatures and climatic conditions. Main body of unit is "Teflon" TFE with multi-bond metalized area contacting bed plate and upper washer for soldering to accomplish hermetic seal. Nickel-plated brass hardware is used for corrosion and weather resistance. The insulator provides a fluorocarbon-silver metal-



fused seal, permitting insulator to be soldered directly to deck. This seal is capable of holding a vacuum and containing oil for indefinite periods. Due to resilience of "Teflon", there is no strain point due to different thermal expansions often encountered in glass-to-metal and ceramic-to-metal seals.

Garlock Electronic Products Garlock Inc., Camden 1, N. J.

New OTC "Two-Stage" Hydraulic Pumping Unit



DELIVERS FROM 600 CU. IN./MIN. @ 100 P.S.I., TO 50 CU. IN./MIN. @ 10,000 P.S.I.

COMPACT, LIGHTWEIGHT; WEIGHS ONLY 45 LBS.

10 3/4" x 12 5/8" AND 17 1/2" HIGH

The amazing, new OTC "Vanguard" power package is a quiet-operating, precision-built, two-stage pump, driven by a universal motor and consisting of a gear pump and a five-cylinder axial-piston pump.

Top quality materials and workmanship assure efficiency and long life for maintenance, production and O.E.M. A variety of valves, controls and accessories are available.

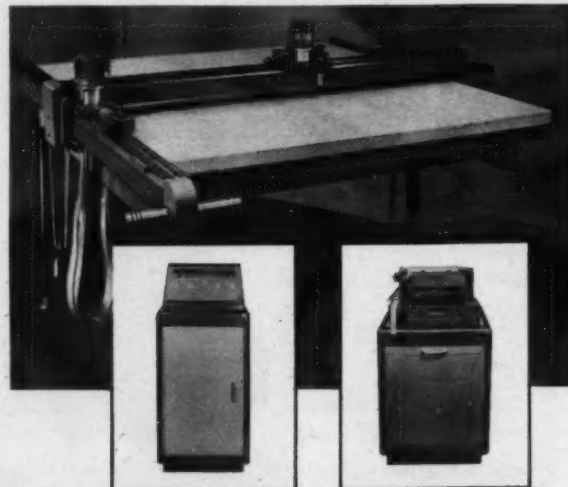


For more information, write:

OWATONNA TOOL COMPANY

720 Cedar St., Owatonna, Minnesota

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Announcing... a fully-automated coordinatograph ... the new Aero/Haag-Streit!

This fine new precision instrument gives uniquely accurate layouts or measurements of coordinate positions and grid systems—automatically!

NOW! Punched paper tape, card, or keyboard input (right inset)—giving automatic plotting to within .0015"

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Aero Service Corporation

Precision Instruments Division
 210 E. Courtland St., Phila. 20, Pa.

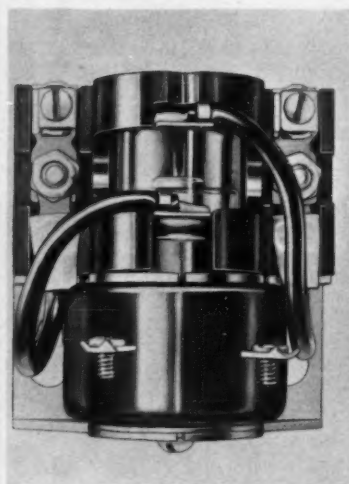
Circle 94 on Reader-Service Card for more information

DESIGN NEWS—FEBRUARY 13, 1961

Plunger-Type Mercury Relay

339

Silent and chatterless in operation, this relay is suitable for heavy-duty loads such as resistance heating; heat-treating furnaces; drying equipment; welding; and illuminated signs and scoreboards. The unit contains only one moving part and can provide millions of operations with speeds up to 100 makes or breaks per minute at rated load. The hermetically-sealed contact cannot be affected by dust, dirt, grease, moisture or oxidation.



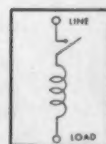
Screw-type terminal clamps for load circuit are integral part of molded block. Contact rating and specifications include: general a-c (120v 30 amp), (240v 20 amp), (440v 8 amp); d-c (120v 15 amp), (240v 10 amp), (motor rating a-c 1 phase 120-240v 2 hp). Non-inductive a-c heater load rating (120v 35 amp), (240v 25 amp). Coils are interchangeable and available for 24, 120, 240 and 440v a-c.

Mercoird Corp., 4201 Belmont Ave., Chicago 41, Ill.

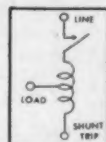


Circle 95 on Reader-Service Card

Heinemann's new VP breaker can work for you as two (or more) components in one. This matchbox-small breaker protects against overloads, also performs many specialized functions. (The internal circuits shown below will suggest its possible uses.) ■ The subminiature VP is magnetically actuated, requires no de-rating. You can have it with any integral or fractional rating from 0.050 to 15 amps (110V, 60 or 400 cycles AC, or 50V DC), and with a choice of several time-delay characteristics. Details on performance, construction and other points of engineering interest are in Bulletin VP; write for a copy. *Heinemann Electric Co.* 105 Brunswick Pike, Trenton 2, N. J.



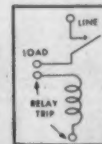
Series-Trip—Overcurrent sensing and circuit interruption take place in the protected circuit; breaker can double as a toggle switch.



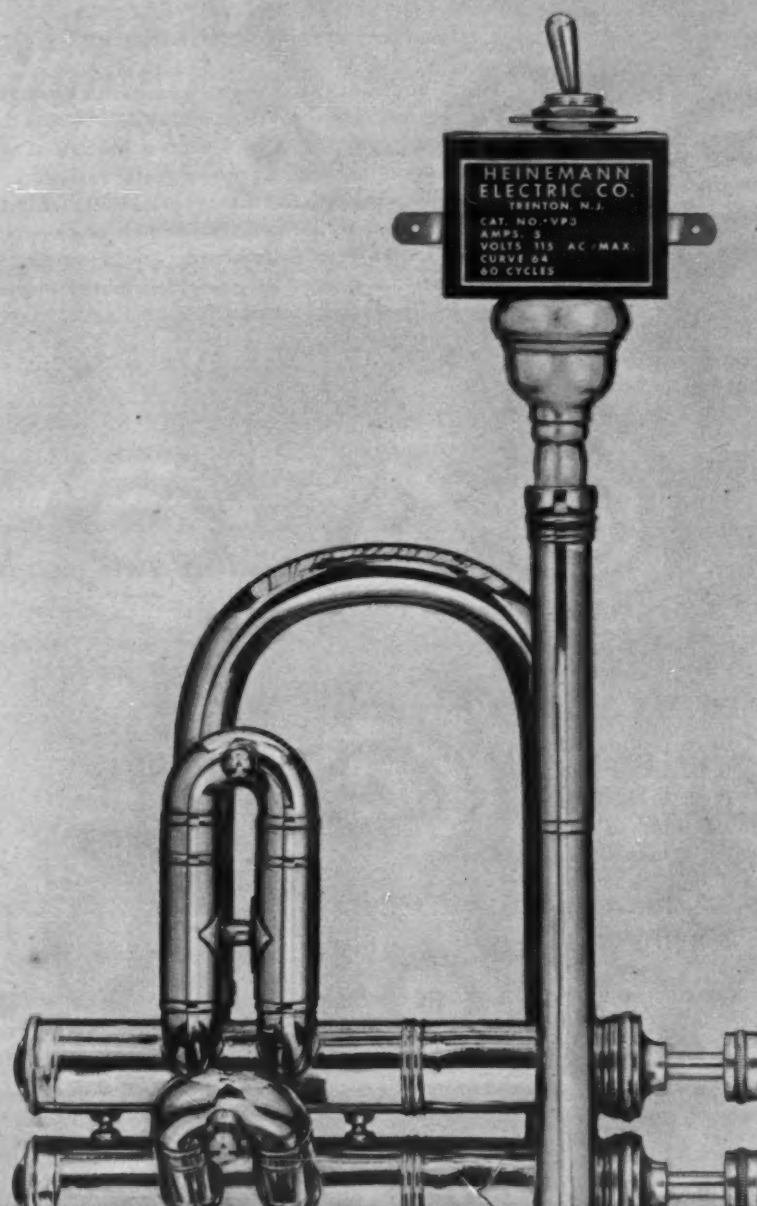
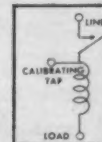
Shunt-Trip — Permits remote tripping through appropriate circuit-closing contacts in control or safety device. Shunt coil operates on line voltage.

DOUBLES IN BRASS

Relay-Trip—Provides a separate control circuit through the coil terminals; any voltage or current can be used to trip the breaker remotely.



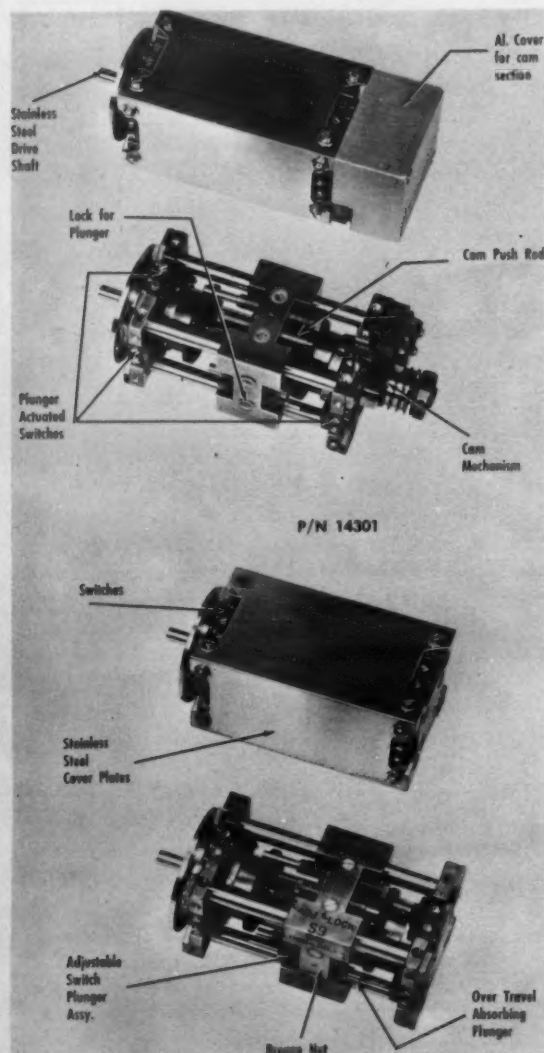
Calibrating-Tap—Permits control of two circuits, with tripping in response to overloads in main circuit only; may be shunted to raise current rating.



ELECTRICAL

Limit Stop Assemblies

340



Programming can be obtained by use of these limit stop assemblies. Designed for 50 turns (optionally 10 or 83), these devices can accommodate up to 8 settings, operated by push-rod plunger assemblies. Up to 8 switches can be actuated discretely at any position within the 50 turns. Switch actuation accuracy is ± 5 deg or 0.027 percent. One cam-actuated switch can be added to the assembly and will repeat more accurately, ± 2 deg or 0.011 percent. An anti-backlash device, as well as end-position, energy-absorbing springs, are incorporated in the design.

United Control Systems, Inc., 918 Woodley Rd., Dayton 3, Ohio.

'Watertight' Indicator Light

341

The L16,200 indicator light comes with grey silicone-rubber boot with panel sealing rib, providing watertight lens and high performance reliability. The unit is available with 6, 14 or 28v lamp and features front-of-panel lamp replacement, anodized aluminum case and a selection of 7 lens colors.

Control Switch Div., Controls Co. of America, Folcroft, Pa.



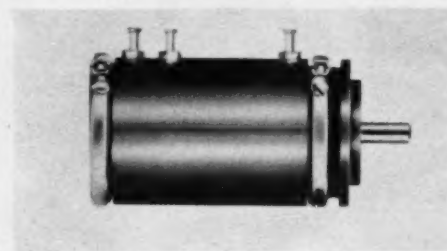
Multi-Turn Potentiometer

342

A multi-turn, precision, wirewound potentiometer, available in 3, 5 and 10 turn, has $2\frac{1}{2}$ w power rating. The 3200 series is capable of modification to special requirements, including: addition of up to 46 extra taps (on 10-turn types), 3 ganged sections, special resistance characteristics, and servo or standard panel mounting. All cases are molded of glass-filled diallyl phthalate for fungus, acid and alkali resistance, high impact and thermal strength and insulation resistance. Solid brass terminals are gold plated for best electrical contact and corrosion resistance. The potentiometer meets NAS 710 specifications for humidity, vibration, salt spray, fungus, corrosion, sand and dust; operates in the ambient

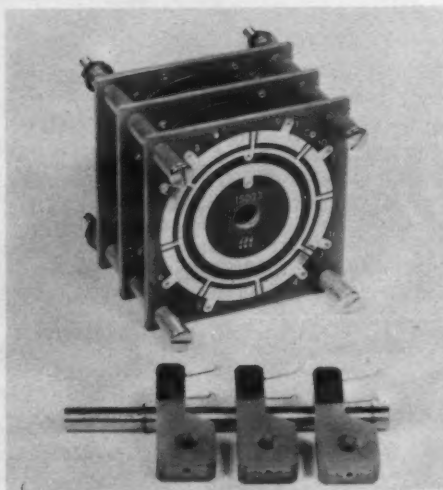
temperature range -55 through 105°C ; is capable of withstanding over 100g acceleration.

Duncan Electronics, 1305 Wakeham Ave., Santa Ana, Calif.



Plated-Contact Switches

343



Any number of circuits, poles and contacts can be packaged as a single integral unit in commutating, programming and sampling switches. Rhodium-plated contact switches are bonded to dielectrics such as glass epoxy, paper epoxy or synthetic mica. Precious metal brushes receive signals for transmission to associated equipment. Units are customarily motor-driven at speeds up to 3600 rpm and also can be coupled to stepping or timing motors and manual drives.

Rotary Devices Corp., 40 Jay St., Englewood, N. J.



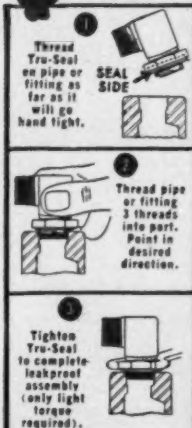
Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 300° F.—without the use of pipe dope. Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
7NO20 York Rd., Bensenville, Ill.

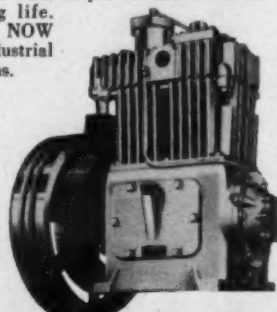
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.



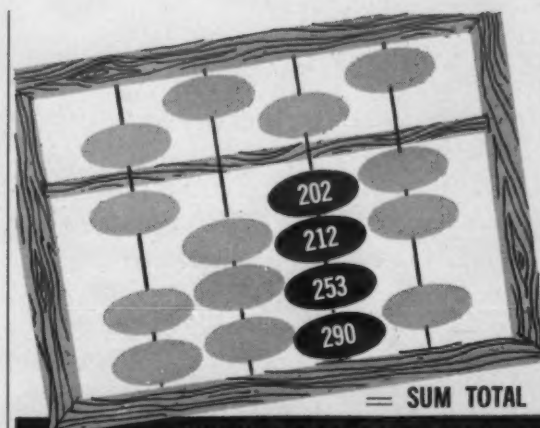
1 more good reason to think about Quincy

CUSHIONED STEEL VALVES assure extremely quiet operation for QUINCY COMPRESSORS. Each valve and seat is a separate assembly that can be removed for inspection without disturbing the other valves. Designed by engineers who have pioneered air compressor advances for 40 years, each QUINCY is built to provide maximum service efficiency and long life. CHECK THE "Q-LINE" NOW—a complete range of industrial models for all applications.

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QUINCY COMPRESSOR CO., Quincy, Illinois
Makers of the World's Finest Air Compressors



an EPOCAST EPOXY RESIN FORMULA for any ELECTRICAL INSULATION PROBLEM!

More than 30 different formulas are now in stock to solve your electrical insulation problems. Whether it be an extreme environmental condition or a normal impregnation, encapsulation or coating project, there's a Furane epoxy resin to fit your requirements.

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INCORPORATED



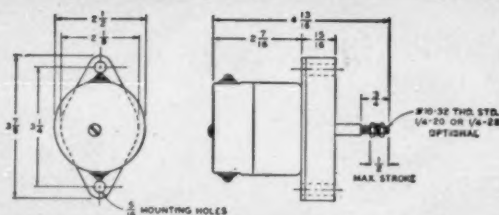
WEST COAST/4516 Brazil Street, Los Angeles, California CHapman 5-1151
EAST COAST/42 Chasner Street, Hempstead, Long Island, N.Y.

Circle 96 on Reader-Service Card for more information

Circle 97 on Reader-Service Card for more information

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D. C. SOLENOIDS



Synchro-Start SL SERIES SOLENOIDS

are for operating engine throttles, fuel pump racks, chokes, etc. and are available with several variations. Other models in 1" and 1½" strokes.

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(D. C. Only)
6V. 12V. 24V. 32V.

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Continuous

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(Pulling)

55A. 35A. 15A. 12A.

CYCLES

Not to exceed 6 per minute

PULL

Approximately 10 lbs. over ½" stroke

CURRENT DRAW
(Holding)

1.6A. .8A. .4A. .3A.

WEIGHT

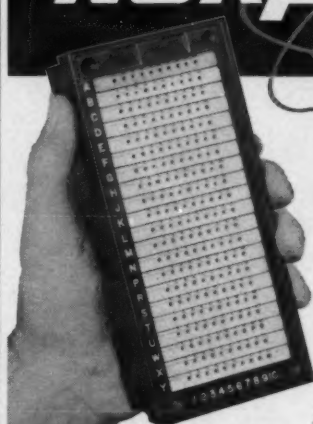
2¼ pounds

SYNCHRO-START PRODUCTS, INC.

8151 N. RIDGEWAY AVENUE • SKOKIE, ILL.

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PROTECT VITAL HYDRAULIC PARTS with *Seal-Guard* METALLIC ROD WIPERS

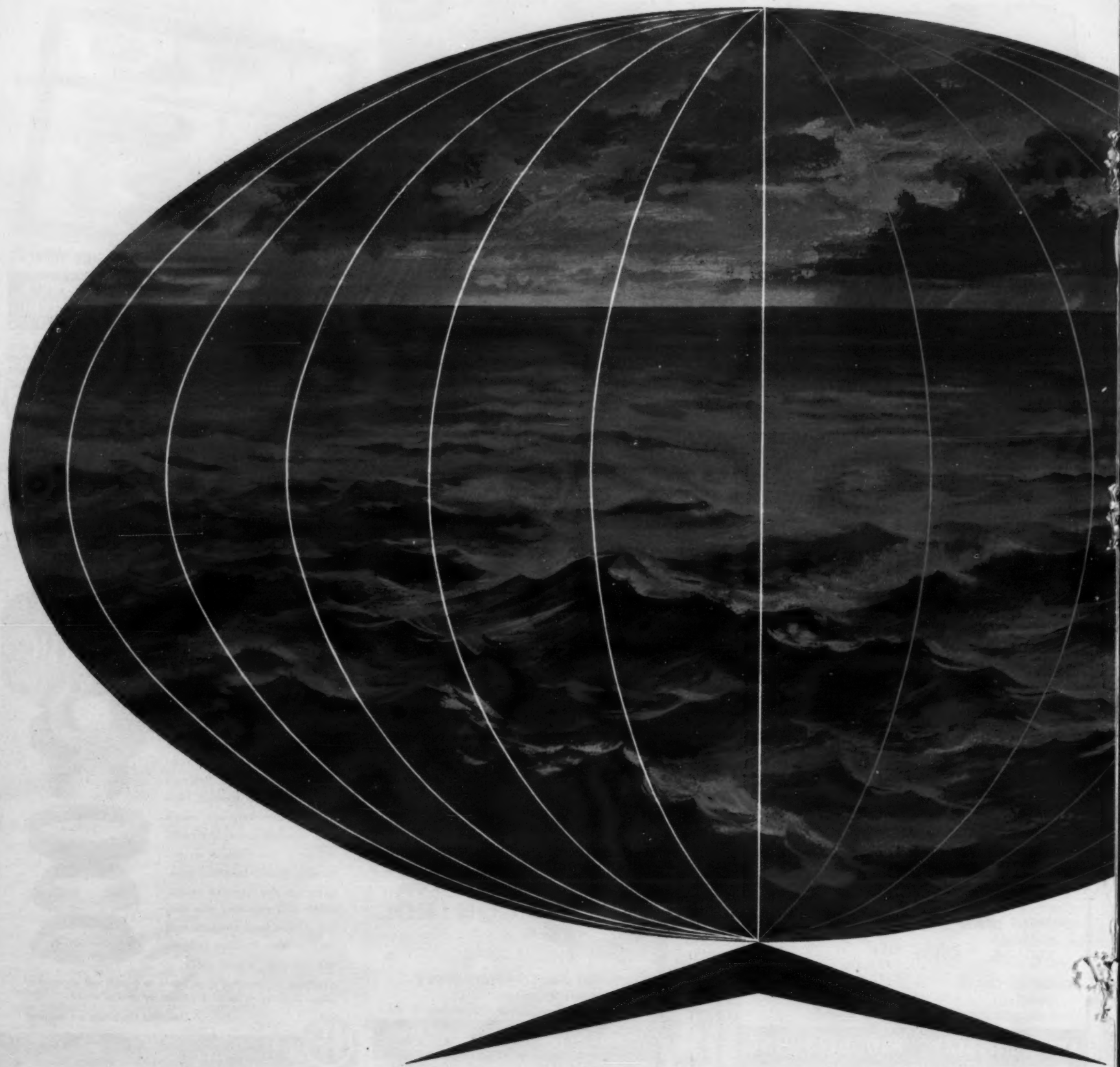
Bronze, knife-edged rings, mounted in a synthetic rubber cushion ring, remove rust, scale and foreign particles before they can reach vital internal parts. The cushion ring, compressed on assembly, exerts constant pressure on the bronze rings. Rings will not mar the rod, are oil and heat resistant and friction-free. Packing failures are literally "wiped out"!

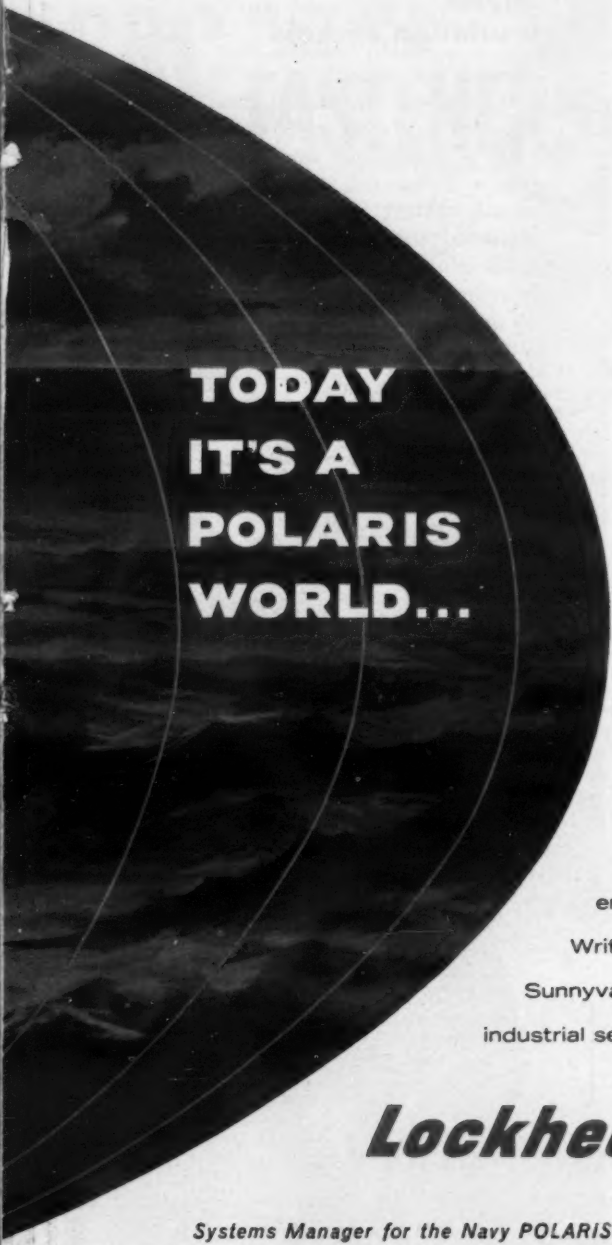
Available in standard sizes for ¼ to 6 inch rod diameters. Larger sizes up to 24½" diameter by special order.

Detailed literature on request



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President Eisenhower thus characterized the POLARIS Fleet Ballistic Missile — capable of being launched from hidden nuclear submarines anywhere in the oceans of the world.

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Similar challenging opportunities are continually developing at Lockheed.

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Write Research and Development Staff, Dept. M-16C, 962 West El Camino Real,

Sunnyvale, California. U. S. citizenship or existing Department of Defense

industrial security clearance required.

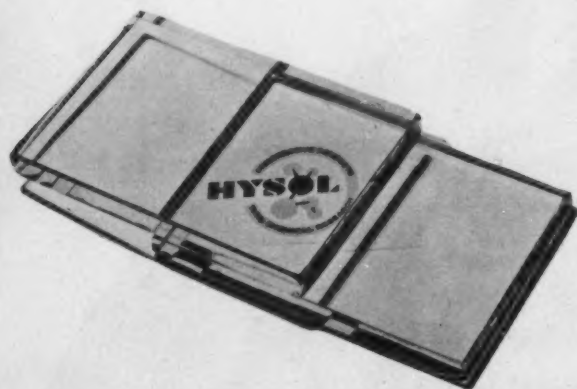
***Lockheed* / MISSILES AND SPACE DIVISION**

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MATERIALS

Epoxy Adhesive Kit



344

No. 0151 resilient epoxy adhesive kit contains adhesive material with high tensile shear values of 2400 psi in a thermal range of -50°F to 150°F . Bonding is good at higher temperatures. Both resin and hardener are packaged in flexible tubes for handling ease. The resin and hardener appear cloudy when first mixed but turn to a clear film in 1 hr at 77°F . The kit is recommended for glass to glass, pyroceram to glass, metal to glass, repair of printed circuits, strain gages and similar bonding and repair application.

Hysol Corp., Olean, N. Y.

'Mylar' Insulation Jackets

345

Fast, easy and economical insulation of a wide variety of electrical/electronic parts is possible by means of "Mylar" jackets. Fabricated from film laminated to polyethylene, they may be shrunk or expanded without breaking down material structure. There is no need for a crystalline bonding agent. Material may be used on capacitors, coils, screws and other parts where insulation against

Thin-Wall Brass Tubing

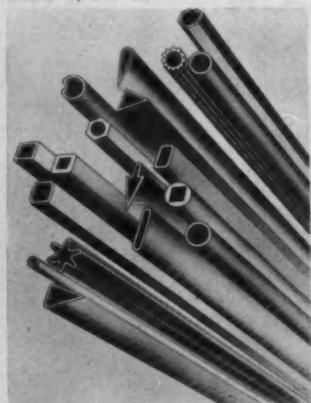
346

has high surface finish

Alloys 70/30 63/37,
ASTM B135, Admiralty
brass 70/29/1. ASTM B111.
Walls 0.005 to 0.030 inch.
OD 0.050 to 0.500 inch.
Shapes round, elliptical,
tear-drop, polygonal, poly-
gonal outside and round in-
side, special.

Lengths $\frac{1}{4}$ inch to 15 ft.
Tolerances as narrow
as $\frac{1}{4}$ of ASTM B251 values.
Temper, hardness, grain size
..... to ASTM or custom-
er specifications.

Avins Industrial Products
Corp., 50 Broadway, New
York 4, N. Y.



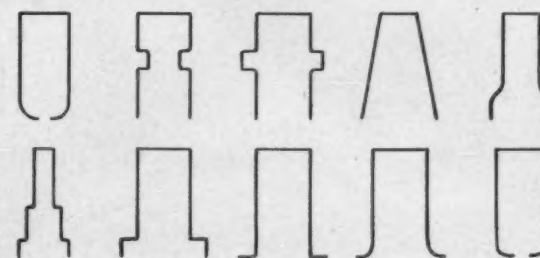
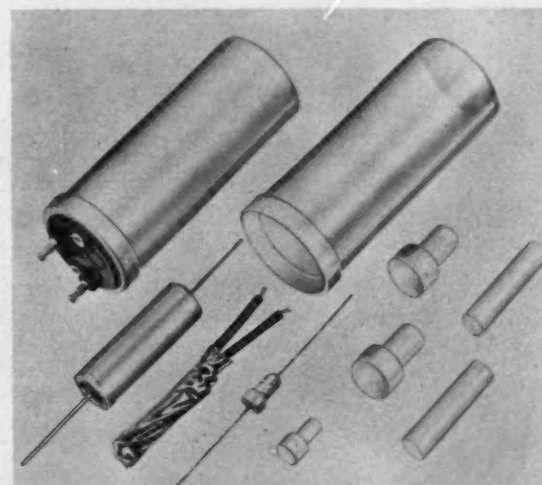
Oil Leak Sealant

347



A positive sealant called "Oyltite-Stik", for emergency sealing of transformer oil leaks through cracks or pinholes in welds or joints, can be used while transformer is still in service. Sealant will stop leaks even while oil is seeping through cracks or splits. It is not affected by temperature changes; remains plastic; and expands or contracts with the part repaired. The stick is dark gray in color and comes in a cylindrical form approximately $\frac{1}{2}$ inch in diameter and 4 inches in length. It is similar to a stiff putty and it is only necessary to rub stick over leak several times in order to force material into the leak.

Westinghouse Electric Corp., P. O. Box 2099,
Pittsburgh 30, Pa.



electrical effects and/or corrosion is required. They are also used to eliminate expensive handwrapping with pressure-sensitive insulation. Material can be supplied color striped for coding purposes.

Precision Paper Tube Co., Dept. DN-1,
2035 W. Charleston St., Chicago 47,
Ill.

25

- ☐ Reduce costs
- ☐ Simplify assembly
- ☐ Improve appearance with

GRC FASTENERS

GRC MOLDED NYLON SCREW INSULATORS AND WASHERS

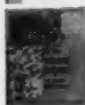


Wide flanges isolate screws from mounting surfaces. Washers and insulators ideal as light load bearings, for shock load, irregular surface, sealing, vibration dampening and other applications. Prevent galling under screw heads. Feature nylon's low dielectric constant, relative high strength. Wide variety of stock lengths for No. 4 to 1/4" screw sizes.

- High in quality
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Produced in one high speed automatic operation, GRC's exclusive methods assure uniformity, smooth, rustproof & corrosion resistant surfaces and the lowest possible cost. New kinds of fasteners never before available . . . modifications in stock fasteners for specialized use . . . infinite variety in styles, types and sizes, have been made possible by GRC's special automatic die casting and molding machines.

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Genuine Bund-L-Tite® nylon straps are twice as long and fully 10 times as strong as any other bundle-tying strap made. This means that you can secure larger bundles at greater stresses. Bund-L-Tite is fast and simple, too: just pull the self-locking strap around the wires. No tying, no knots, no hitches to come loose. Light-weight DuPont zytel meets MIL-P-17091. 1/2" size holds 40 lbs. tension; 3/4", 175 lbs.; 1", 325 lbs. IMITATED BUT NOT DUPLICATED. Write for free literature.

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SECOND EDITION

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Manufacturers of over 85% of the torque wrenches used in industry

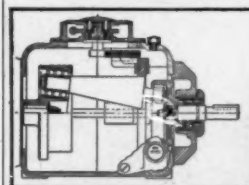
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Engineering Data
Screw Torque Data
Adapter Problems
General Principles

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DESIGN NEWS—FEBRUARY 13, 1961

INFINITE RANGE EXTREME ACCURACY...

Get Both



WITH **Graham** VARIABLE SPEED DRIVES

The Graham Drive gives extreme accuracy of speed holding and reset from any desired top speed to zero. Range and accuracy are assured through the correct application of metallic traction in the first stage of a compound planetary system.

Three planet roller cones are canted in a carrier to tractionally engage an encircling control ring . . . Pinions on the large ends of the rollers mesh with a ring gear joined to the output shaft . . . Speed is changeable running or stationary . . . Planetary action provides overload protection. The dial permits settings to one part in 4000.

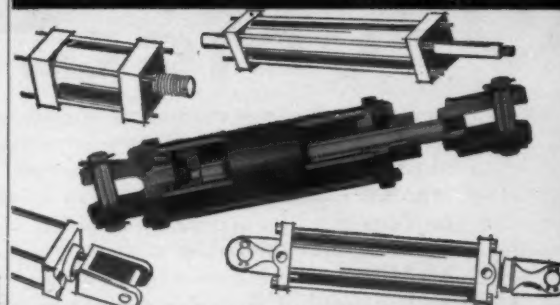
A wide choice of built-in motors, reducers and controls is available in sizes-fractional to 3 HP. Write for full performance data.

Ask for Graham Catalog 550.

Graham TRANSMISSIONS, INC.
Menomonee Falls, Wisconsin

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there's a **CROSS** air or hydraulic cylinder that will work for you*



*Cross Air or Hydraulic Cylinders save money, do the job better! To be sure it's the best cylinder designed for your job—select Cross. Cross cylinders are designed around component parts, easy modified to fit your specific production applications. Cross cylinders are heavy-duty, rugged cylinders for OEM.

CROSS MANUFACTURING CO.
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For more complete data on sizes carried in factory stocks—write today—Engineering Catalog on Cross Air and Hydraulic Cylinders available on request.

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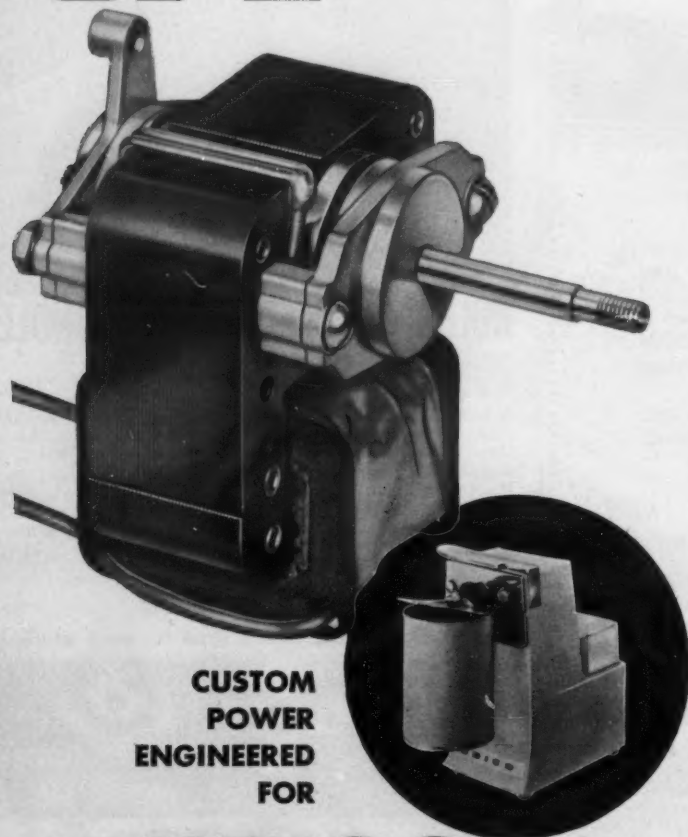
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Household appliances require motors which will perform year-in and year-out with minimum servicing. That's why Union Die Casting Company selected MAMCO motors for their electric can opener. MAMCO furnishes the power and the dependability which makes UDICO a household word. MAMCO specializes in custom-built motor applications . . . Universal or shaded pole motors custom designed for specific requirements make your product perform better and last longer. Call, wire or write MAMCO today . . . you'll be surprised at how little it costs for

***Custom Power Engineering**

MAMCO

CORPORATION

Racine, Wisconsin

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MATERIALS

Plastic Pipe Cement 348

PVC plastic pipe compounds are now available in colors to match needs of individual requirements. They are also available with drying speeds to meet particular requirements of small or large-section bonding. Compounds are based on pure, unmodified and unplasticized polyvinyl chlorides that provide chemically resistant bonds with pipe properties. They dissolve pipe and fitting surfaces to form a fused, inseparable, permanent bond. When hardened, the bond is integral with pipe. Result is a bond that resists acids, alkalies, water, gasoline and oils.

Schwartz Chemical Co., Inc., 50-01 Second St., Long Island City 1, N. Y.

Tritium Foils 349

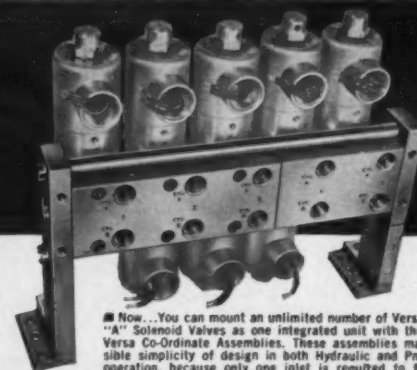
Titanium tritide (TiH^3) foils are offered for use as ionization sources, beta supplies for nuclear batteries, beam targets in neutron generators and in gas chromatography. Two types of backing are presently available—stainless steel, type 302 with thickness of 0.002 inch; and copper, type OFHC (oxygen-free high conductivity) with thickness of 0.010 inch. Tritium content of foils is nominal 1/curie/in² (0.16/curies/cm²). Other tritium concentrations are available on special request.

U. S. Radium Corp., Morristown, N. J.

**UNLIMITED
MANIFOLD MOUNTING
OF VERSA SERIES "A" SOLENOID VALVES**

WITH **VERSA**

Co-Ordinates



Now... You can mount an unlimited number of Versa Series "A" Solenoid Valves as one integrated unit with these new Versa Co-Ordinate Assemblies. These assemblies make possible simplicity of design in both Hydraulic and Pneumatic operation, because only one inlet is required to feed the entire line of valves. Additional blocks can be added at any

time and blocks with and without adjustable built-in bleed controls can be used together in one unit. Combined with Versa Series "A" Valves these Co-Ordinates provide the most flexible and reliable Multiple Solenoid Valve Assemblies in the Control Valve field. Write for Bulletin # 960.

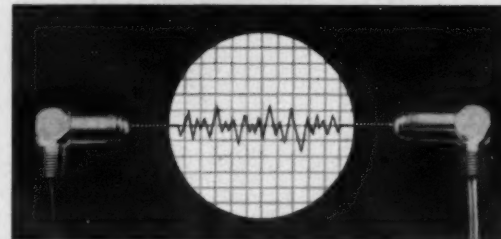
VERSA
Valves

VERSA PRODUCTS COMPANY, INC.
150 Coolidge Ave., Englewood, N. J.

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Everyday users are finding new ways to place PHOTOMATION "electric-eyes" on high speed production lines. Where speed, accuracy and constant performance count the most. The new 1961 line of miniaturized units are designed to do the impossible jobs . . . right on the production line. These tiny electric eyes are backed up with years of experience and constant refinements to keep up with automation developments.

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BERGENFIELD, NEW JERSEY



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DESIGN NEWS—FEBRUARY 13, 1961

Epoxy Adhesive 350

"Maraset Resin 533A", a two-part component, contact-pressure epoxy adhesive, can be cured at room temperature to provide high bond strength. The resin is furnished as a solvent-free, non-volatile, medium-thick paste with a 2-hr pot life. It meets MIL-A-8623, Type II. The material is primarily intended to join together aluminum, steel, brass, copper, magnesium and combinations of these metals. It is also useful to bond wood, glass, rubber and plastics, as well as reinforced plastics such as laminates of polyester and fibrous glass. Tests on aluminum-to-aluminum bond show tensile shear strength of 3900 psi after 10 minutes at 180F, 3100 psi after 80 minutes at 150F, and 2650 psi after 2 days at room temperature. Tensile strength is cited as 8300 psi and hardness as 83 Shore D. Working samples are available.

Marblette Corp., 37-31 Thirtieth St., Long Island City 1, N. Y.

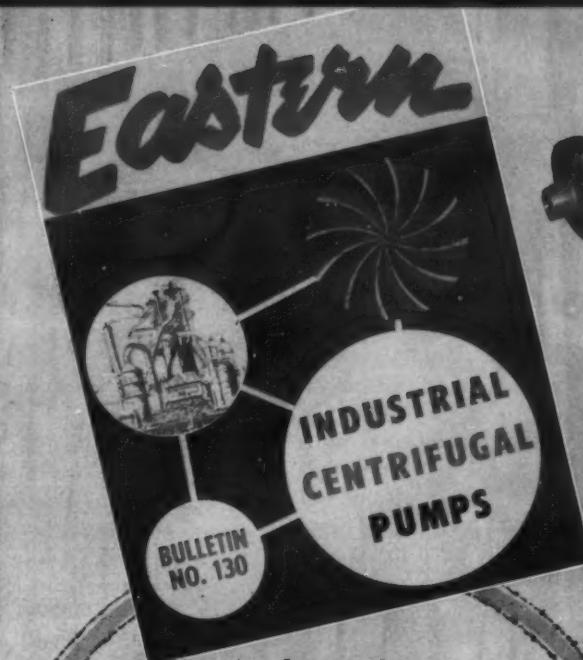
Laminated Plastics 351

High-temperature, thermosetting, laminated plastics provide special materials for the interest in high-temperature laminations. Three plastic laminates with flame-retardant qualities are Grades FR-1, FR-2 and FR-3. High-temperature grades are asbestos woven fabric Grade AA-HT, an asbestos mat plastic (ARF-HT), and a glass fabric plastic (G3-HT). Grade AA-HT, developed for space-age applications, has an asbestos woven fabric reinforcement and a modified phenolic resin binder. This is recommended for applications requiring continuous exposure to 500F. Tests indicate that it retains 40 percent of its mechanical strength after exposure to 500F for 1000 hrs.

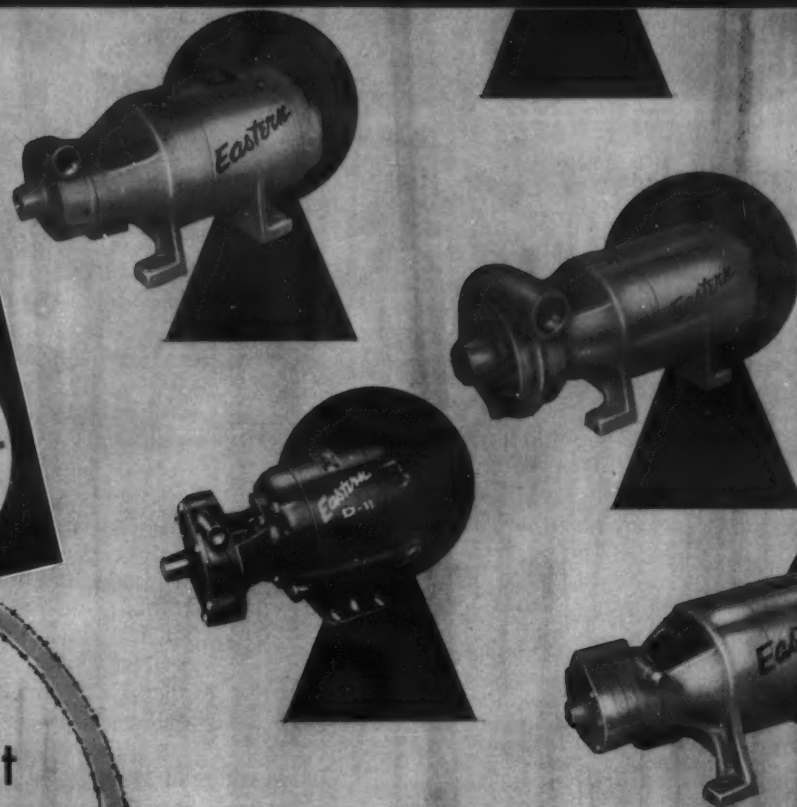
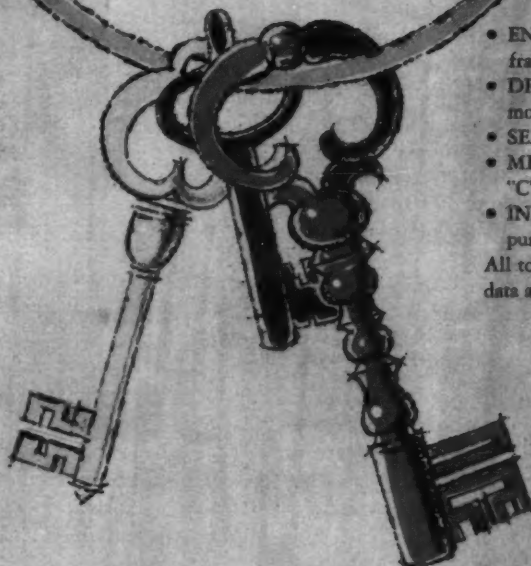
Synthane Corp., Oaks, Pa.



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your key
to the perfect
choice of
**CENTRIFUGAL
PUMPS**



A new catalog opens wide the doors to designers of process equipment — tells all you need to know in terms of engineering data, performance charts, seals, metals, mountings!

If you need centrifugal pumps with these characteristics, this reference book is for you:

- **PRESSURES:** to 21 psi in single stage pumps; to 70 psi in multi-stage types.
- **FLOWS:** capacities to 70 gpm in single-stage pumps, to 10 gpm for multi-stage models.
- **MOTORS:** standard motors for 115/230 volts 60 cycles 1 phase (other electrical characteristics available). Power range from 1/2 to 1 1/2 H.P.
- **ENCLOSURES:** drip-proof, totally enclosed, and explosion-proof ballbearing frames.
- **DRIVES:** Space-saving close coupled pumps most rugged and popular. Pedestal mounted arrangement without motor available as alternate for belt or coupling drive.
- **SEALS:** a variety of rotary seals and stuffing boxes, to fit every application.
- **METALS:** your option of cast iron, bronze, stainless steel, Monel, Cast Iron, Hastelloy "C".
- **INSTALLATIONS:** a wide range of transfer, recirculation, feed, boost and filter-pumping applications.

All told, 50 different models are described in full — and you get a wealth of technical data as well. Write for new catalog 130 now!



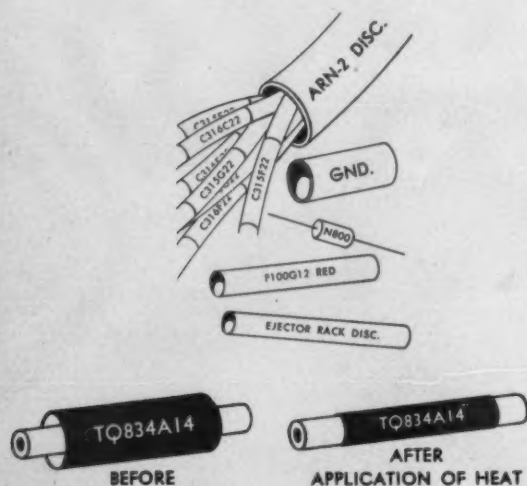
**EASTERN
INDUSTRIES,
INCORPORATED**

100 SKIFF STREET, HAMDEN, CONN.
WEST COAST OFFICE 4203 Spencer St., Torrance, Calif.



Pre-Printed Insulation Sleeving

352



"Shur-Code" is a printed insulation sleeving that is slipped over wires, cables and harnesses for permanent identification. Pre-printed to specifications on one, two or more places around tubing, sleeving is available in many diameters and precut lengths. Material is resistant to fluids and chemicals. WHT-700 heat-reactive "shrinking" tubing is supplied in expanded form; with application of heat, sleeve shrinks to tight fit of predetermined size. Materials meet MIL-I-18057A, MIL-I-7444A (2), MIL-I-631C, MIL-I-3190/A and other specifications. Free working samples available.

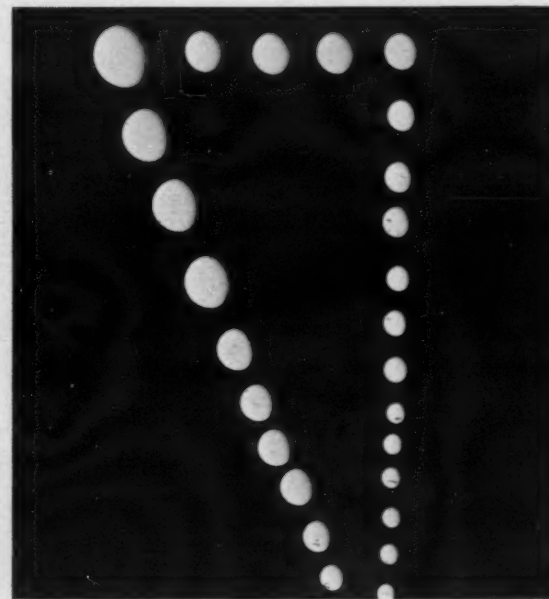
Westline Products Div., Western Lithograph Co., 600 E. 2nd St., Los Angeles 54, Calif.

Anti-Friction 'Teflon' Spheres

353

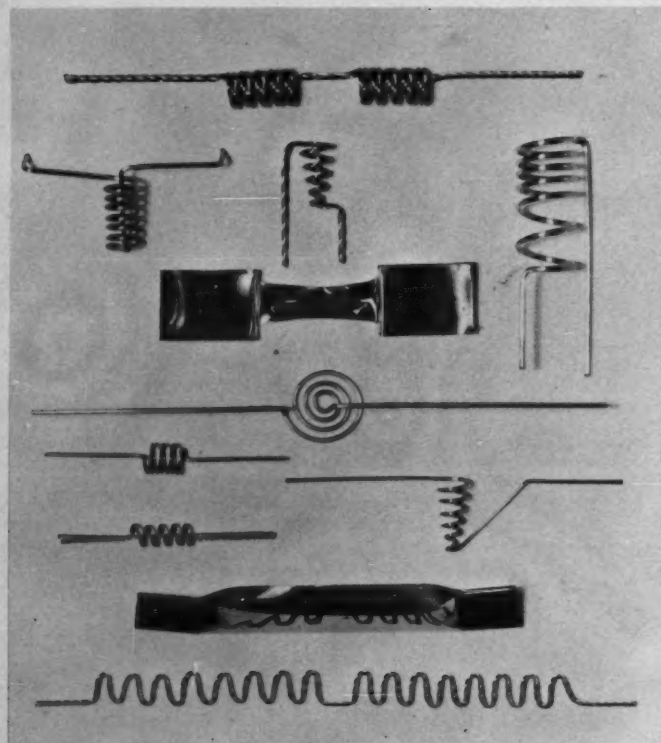
"Teflon" is now produced in spheres to meet exacting tolerance requirements of many critical anti-friction applications. Diameter and sphericity tolerances are maintained within 0.001 inch. High strength of balls is attained through use of 100-percent virgin "Teflon" powder. "Teflon" provides such desirable characteristics as chemical inertness, absence of need for lubrication, and resistance to temperature extremes. Successful tests of close-tolerance balls have been made in such uses as ball bearings, detents, spacers and pivots in conventional and miniaturized mechanical and electromechanical systems. Spheres are capable of withstanding unusually high compressive forces without permanent distortion or failure. Balls need no lubrication against friction due to resin's low coefficient of friction—0.04 against steel. Operating temperature range is from cryogenic to about 500F.

Tri-Point Plastics, Inc., New York, N. Y.



Filaments and Boats

354



Tungsten, tantalum and molybdenum filaments and boats are available in a variety of sizes and shapes. Manufactured for use in high vacuum as an evaporation source, components are processed to maintain a high standard of purity and accuracy. All parts are stress relieved to obtain a long life in operation and to maintain their geometry during use. Primary uses include: electronic component processing, coating of optics, plastics and decorative coating, precision instrument manufacturing and vacuum metalizing in basic research laboratories.

Allen-Jones, Inc., Electronics Div., 1345 Gaylord Ave., Long Beach, Calif.

Electrical Insulation

355

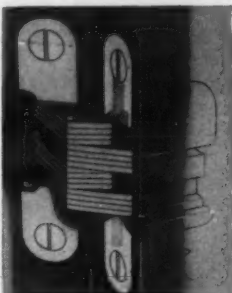
A Class F temperature-insulation made from epoxy glass laminate is manufactured in curve-formed and square-formed wedges. The formed wedges will combine superior heat resistance, dielectric strength, toughness, dimensional permanence, and will provide wedging that will improve performance of electrical equipment. It is made in two wall thicknesses, 0.020 and 0.025 inch, in a range of standard sizes.

Insulation Manufacturers Corp., Inmanco Div., 565 W. Washington Blvd., Chicago 6, Ill.

NEW INVISIBLE HINGES

General Purpose Hinge Creates Flush Surfaces

These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.



SOSS MANUFACTURING COMPANY, Dept. DN-26, P. O. Box 38, Harper Station, Detroit 13, Michigan.

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Shaft Retention FASTENERS.

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Featuring Fastex® Springrip Fasteners. Springrip Fasteners simply slip on shaft or stud. Biting teeth resist dislodging movement. Full story told in new catalog containing data on Springrip Fasteners, Plasti-Rings®, Push-On Fasteners and "C"-Rings.

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THE UNIQUE SOLID-METAL SCREEN
FOR PRECISE FILTRATION AND
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The non-ravelling screen that can be soldered, brazed or welded, as well as readily fabricated. Holes have the natural taper ideal for critical filtration, and resist deformation under pressure. Electroforming permits precise control of thickness and hole-size. "Counts" of 25, 40, 65, 80 and 100 in copper and nickel-on-copper 36" wide by 100 feet long — smaller sheets are available in pure nickel, pure copper, or nickel-on-copper in "counts" to 400. Write today for information on how Lektromesh can help you. Address Dept. 22.

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USE BRONZE

In services up to +500° F and down to -400° F, Ampco metal has proven its ability to retain an unusually high percentage of its room-temperature characteristics. This series of special copper-base alloys is available in most any form.

Write for Bulletin PI-5

500° ABOVE 400° BELOW

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Dept. 408, Milwaukee 1, Wisconsin
West Coast plant: Huntington Park, California
Southwest plant: Garland (Dallas County), Texas

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STANDS ALONE!

Type SN
Johnson
ROTARY
PRESSURE
Joint

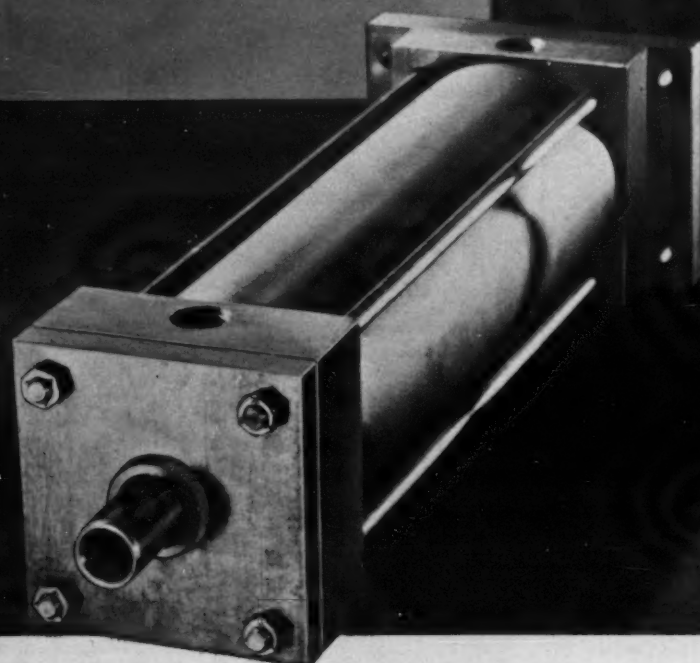
There's not another rotary joint like the Johnson Type SN. Used where inlet or outlet pipe must rotate with the roll—on certain paper machines, drilled rolls of rubber or plastic mills and calenders, double shell dryers, and the like. Needs no external supports of any kind. Like all Johnson Joints the Type SN seals without packing, needs no lubrication or adjustment.

Investigate Johnson Joints for all steam-heated or water-cooled rolls. Handle Dowtherm, Monsanto Aroclors, hot oils too. Sizes to 8". For data on Type SN write for Bulletin N-2002.

THE JOHNSON CORPORATION
831 Wood St., Three Rivers, Michigan

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an air line
to this cylinder
AND MAKE
YOUR DESIGN JOB
A LOT EASIER**



The cylinder simplifies your design work substantially, because it produces virtually any kind of motion—and does so *without the use of complex mechanical contrivances!*

It provides constant, even pressure at all times, and this pressure can be varied with a simple adjustment. Its compact size, along with the use of a flexible line, makes it easily adaptable to

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MATERIALS

'Teflon' Tape 356

Applications where cost of plastic tape has been prohibitive and substitutions inadequate, can now have improved performance with this material. "Fluorolin 101-R" can be used for outer protective wrappings, release and non-stick surfaces, protective coatings for ease of cleaning and for wear strips or discs. It is useful for multi-mechanical applications and minimized electrical requirements.

Joclin Mfg. Co., Lufbery Ave., Wallingford, Conn.

Self-Adhesive PVF 357

Polyvinyl fluoride film is now manufactured in self-adhesive form. Coated with high-strength pressure-sensitive adhesive, "Tesar" can be permanently bonded to a range of materials to provide a long-wearing weatherproof surface. It is available in transparent and metallized form, as well as in pigmented colors.

Fasson Products, 250 Chester St., Painesville, Ohio.

Electric Grade Nylon 358

This material can be used to improved advantage throughout electronic, radio and other electrical fields. "Zytel 31" rod will be available in diameters from 1/4 to 3 inches, in natural colors only. The material has a low moisture absorption rate and a high dimensional stability.

A. L. Hyde Co., Grenloch, N. J.



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KEEPS DIRT OUT!

Modern Seal-Guard keeps hydraulic and pneumatic systems clean—protects packings and entire system. Two knife-like bronze wipers throw all contaminants outward as rod retracts into cylinder. Rubber retainer absorbs shock and side load, holds wipers in full contact with rod and provides an overall outside seal.

Send for all the facts on Seal-Guard. Write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

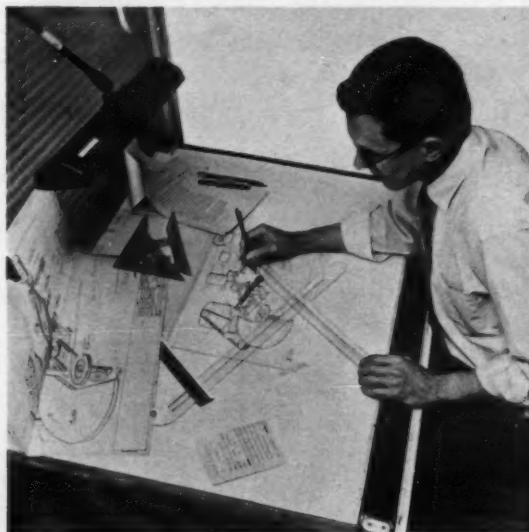
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Graphic Journalism...



Illustrating

DESIGN
DESIGN IDEAS
NEWS

DESIGN NEWS—FEBRUARY 13, 1961

Epoxy Resin Plastic Paste 359

"REN-Shape" is a fast-curing epoxy paste material that features carvability, dimensional stability and easy workability. It is used as a quick, effective method for building and duplicating male and female parts, or as a repair or rebuilding material. The handy squeeze-tube container eliminates possibility of waste and facilitates use where small quantities are needed. Tubes are useful on model or pattern maker's workbench. No weighing is necessary. Ribbons of resin and hardener are squeezed out, mixed and applied. Small quantities can be mixed easily and there is no chance of error in resin-hardener ratio. The material in tubes is also handy in home workshop.

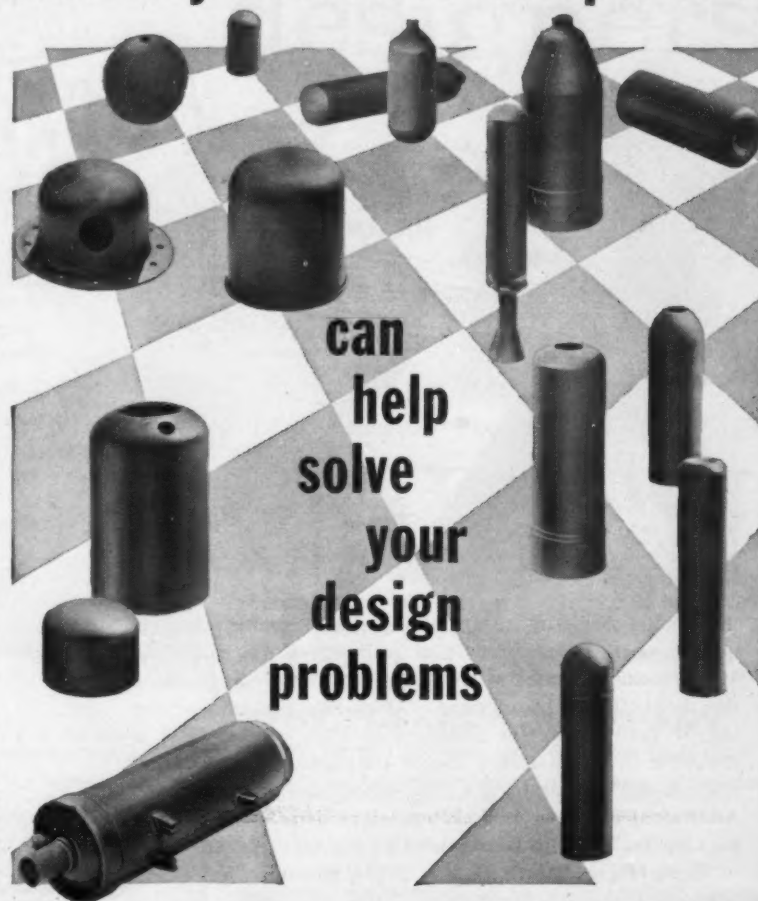
Ren Plastics, Inc., Dept. RP-78, Lansing 9, Mich.

Nylon-Reinforced Fabric 360

A sample packet of fabric films, with several industrial uses including protective covers for machinery and industrial aprons, is available. The light, flexible material is primarily polyethylene, reinforced by nylon fibers. If a tear starts, fibers reinforce each other, providing increased resistance to tear progression. High tear resistance is provided without necessity of costly high-tensile strength.

Griffolyn Co., Inc., 6813 Dixie Dr., Houston, Tex.

Hackney seamless components



can
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solve
your
design
problems

Whatever your shape or shell problem, the solution lies in Hackney deep drawn forming methods. There are two good reasons why:

First, Hackney components are produced the cold drawn way to insure strong, lightweight, seamless shells with smooth, clean surfaces; consistently uniform side walls, and closely controlled tolerances. That's what makes them completely dependable, completely reliable parts of your design.

Second, many of the sizes you need are quickly available because we have a large assortment of dies, mandrels and related tooling. And our experience and facilities are at your disposal to transform any of your design ideas into reality.

Why not let our engineers help you work out details and suggest ways to improve reliability and reduce costs. Your components can be formed in steel, magnesium, nickel, ultra-high-strength stainless steels, hot work tool steels, molybdenum or titanium. Units can be made in sizes from 1 qt. to 100 gal.; diameters range from 2" to 32"; lengths may be from 1/2 to 5 times the diameter, or up to 110". For complete information, write to the address below.

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1440 South 66th Street, Milwaukee 14, Wisconsin

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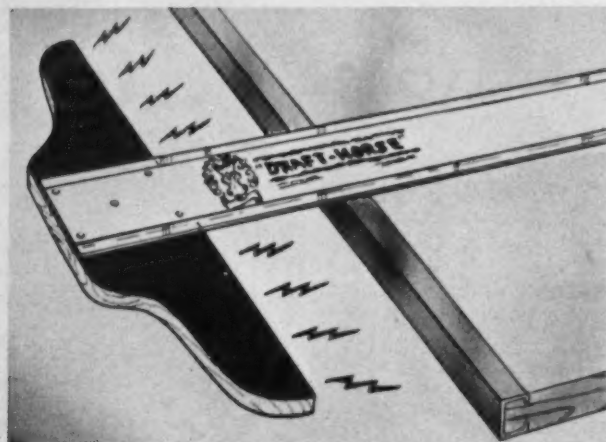
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EQUIPMENT

Magnetic T-Square

361



A parallel bar and magnetic T-square combination requires no installation, cable or pulleys and is removable. Magnetically attracted to board and held firmly in position, the device is easily operated. "Draft-Horse" permits free use of both hands for triangles or instruments. Unit is available in any standard size or packaged with a custom-made board as a drawing kit for school, home or field use. Additional accessory is a chrome steel strip with adhesive backing for use with boards which have no metal edges.

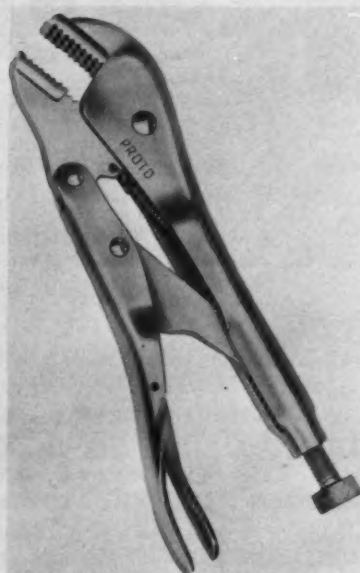
"Erase-Horse" Inc., P. O. Box 20104, Houston 25, Tex.

Lever-Wrench Plier

364

Capable of one-hand pressure up to a ton, the locked jaws of No. 291R lever-wrench plier can be instantly released, even under maximum pressure. One of the more popular models, the device is 4 tools in one: a hand-vise, a clamp, a pipe wrench and a plier. It is fitted with quick-release feature to speed work, particularly clamping applications.

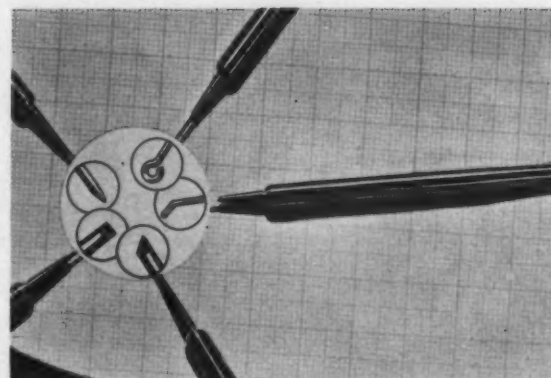
Proto Tool Co., 2209 Santa Fe Ave., Los Angeles 54, Calif.



All-Purpose Precision Tool

362

"Microtools" are engineered tools for electronics and instrument work compatible in size with advanced microcircuitry and components. This line embodies 67 models, all of which are interchangeable in handles provided. Each tool is designed to do a specific microelectronic or instrument job efficiently. Permanent metal handles are shaped and engineered to provide greater dexterity. Cutting edges, points and working surfaces are precision forged, machined, ground or honed to microscopic perfection. Entire tip area behind working element is 24-carat gold plated and shot-burnished to insure corrosion resistance and a contaminant-free tool.



Tools and tool kits are packaged in hinged-lid molded plastic boxes with individual tip protection. This permits visual selection with easy use and proper storage.

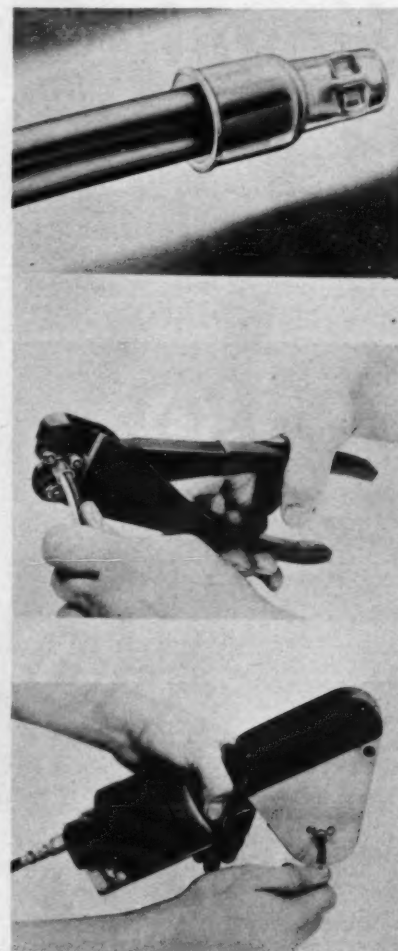
Circon Component Corp., Santa Barbara Municipal Airport, Goleta, Calif.

Splice Cap Tool Combination

363

A pre-insulated splice cap and a ratchet-controlled tri-SURE-tool crimps through nylon insulation without weakening its insulating qualities. This permits users to pigtail-splice a wide range of wire sizes with one size cap and one size tool. The pre-insulated splice cap can be used for 2 through 6 stranded, 3 through 5 No. 18 solid, 2 or 3 No. 16 stranded or solid, 2 No. 14 stranded or solid, 1 No. 12 with 1 No. 14 or equivalent combinations. The fast-acting tool employs three-indent, rolling-action crimp that distributes crimping pressure over a wide area and minimizes thinning of insulation. Both pneumatic and hand tools are available. Crimp depth is automatically controlled by tool's ratchet release. No adjustment or wire twisting are necessary. Hand tool features open end which provides easy use in hard-to-get-at places. Pneumatic tool may be bench-mounted or suspended.

Buchanan Electrical Products Corp., Hillside, N. J.



DESIGN versatility!

with low cost miniature CIRCUIT BREAKER

Available with:

- Two auxiliary contacts, N.O., N.C.
- Two independent circuits
- ON-OFF switch
RATED: 50 milliamps to 25 amps,
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unbreakable construction.
A wide variety of stationary
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→ or materials



Send for this
free catalog

Catalog 92 has 24 pages filled with useful information on neoprene coated fabric, wire reinforced Flexaust hose and Portovent retractable duct applicable to their use in air and materials handling, fume and dust control. Includes data on pressures, friction losses, construction, accessories, and other details essential to good design.

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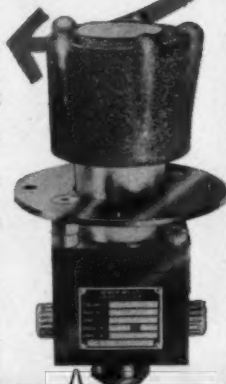
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MORE AND MORE USERS ARE STANDARDIZING ON THIS PNEUMATIC REGULATOR

there's a reason!

- ✓ 6500 psi inlet pressure.
- ✓ Eleven outlet ranges from 0-5000 down to 0-60 psi.
- ✓ Constant outlet pressure regardless of changes in inlet pressure.
- ✓ Integral relief valve — requires no separate adjustment.
- ✓ Temperature range — 65°F to +275°F.
- ✓ Low in cost — immediate delivery.
- ✓ Light Weight (4½ lbs.).
- ✓ Available with manual or electric remote control.

Hi flow — helium, air, nitrogen.
Write for detailed information and prices.

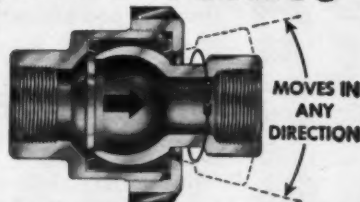


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manufacturing corporation
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BARCO Flexible BALL JOINTS

NOW!
An easy
way
to solve



PIPE EXPANSION PROBLEMS

Barco Flexible Ball Joints make it easy and economical for you to solve many problems where piping EXPANDS and CONTRACTS!

- No heavy pipe anchoring required. No "end thrust" developed under pressure. Minimum space needed.
- Ability to handle compound movement where twisting is also involved.
- Virtually no deterioration. Able to stay in service for years. No lubrication.
- Maximum safety for high temperature and pressure. Sizes ¼" to 12".



Send for
New Bulletin
No. 31

Read interesting Bulletin 31, "How to Solve Piping Flexibility Problems". Complete with piping layout drawings and illustrations. Shows how to cut costs, save time, and do a better job! Ask for recommendations. BARCO MFG. CO., 519C Hough St., Barrington, Illinois.

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NAUGLER MINIATURE flexible COUPLINGS



designed to eliminate
your coupling problems



- ZERO BACKLASH • HIGH TORQUE CAPACITY • ALL METAL •
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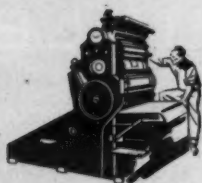


NAUGLER ENGINEERING, INC.
19 MADISON AVE., BEVERLY, MASS., U. S. A.

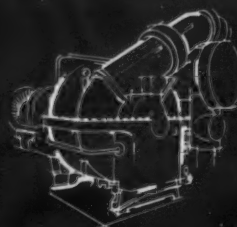
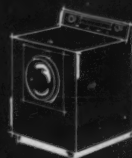
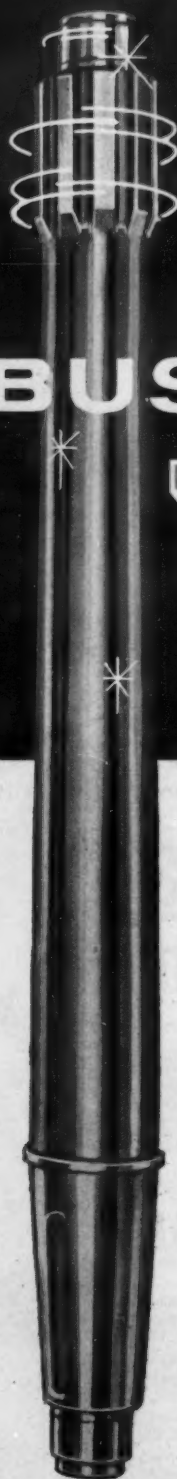
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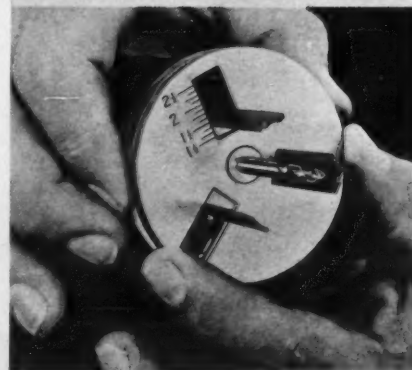
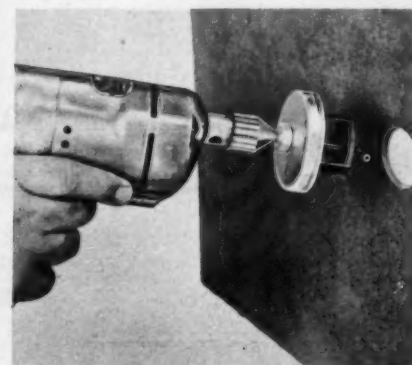
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EQUIPMENT

Adjustable Hole Cutter

365

"Z-Saw" hole cutter is a handy, easily adjustable tool for cutting holes of any diameter variation from 1 1/8 to 2 1/4 inches in materials such as wood, plastic, and aluminum. An extra set of blades is supplied for cutting metal. Power source is a hand drill and small drill press.

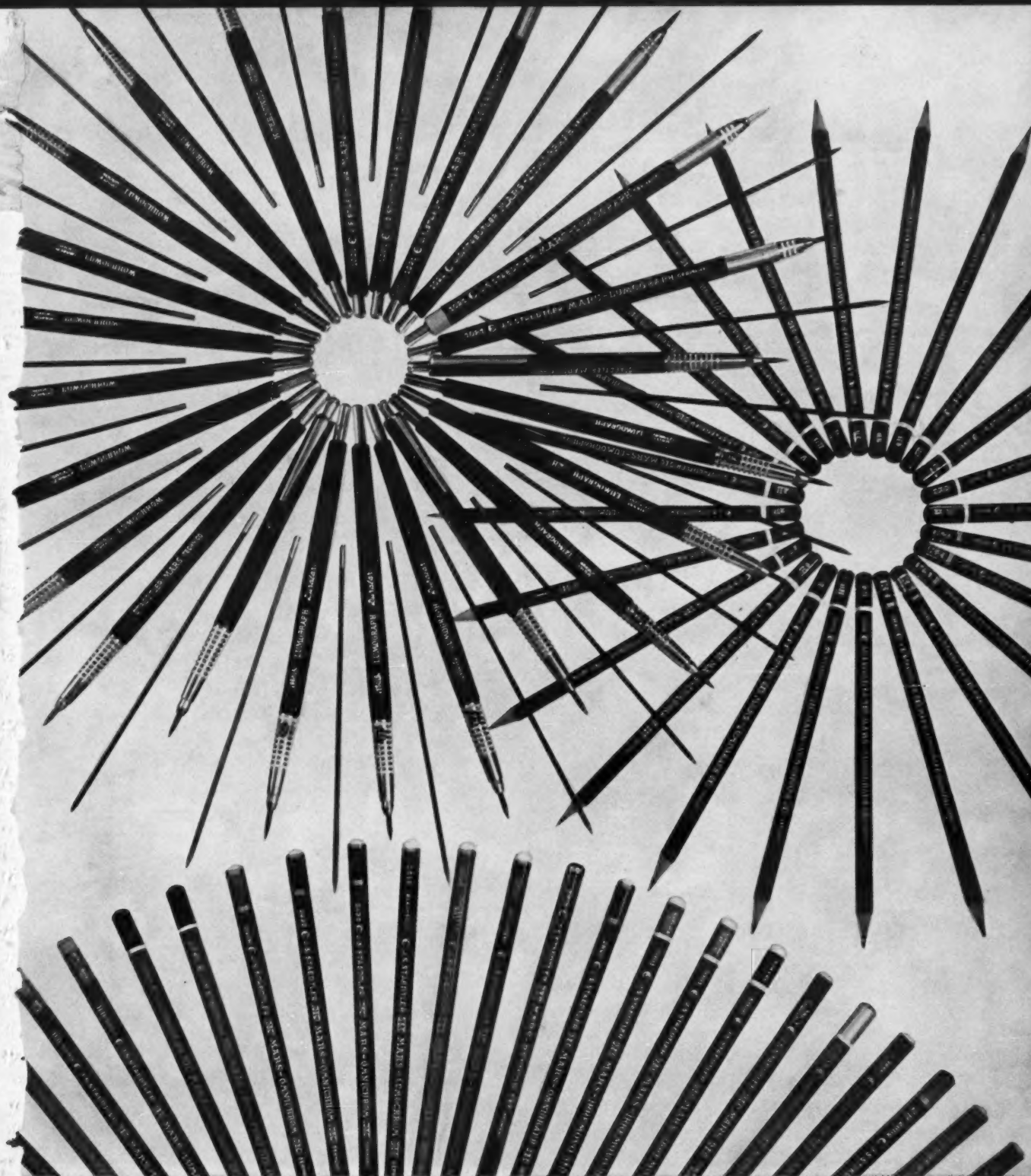


equipped with 1/4-inch chucks. Shank of tool is of alloy steel with a tensile strength of 97,000 psi. Hole size adjustment is simple.

Zoron, Inc., 612 W. Monroe St., Chicago, Ill.



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ALL MARS - ALL TOPS

... all imported from West Germany, made to meet the highest standards of professionals.

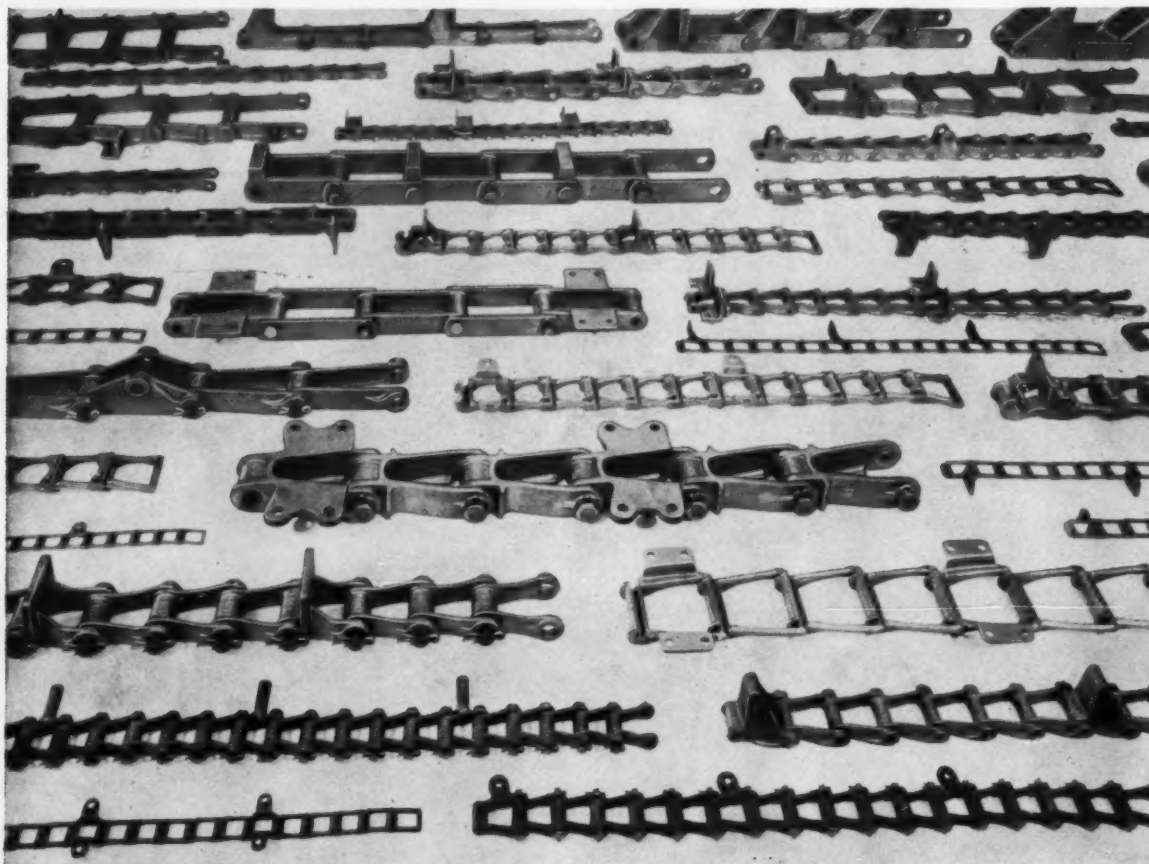
the pencil that's as good as it looks

MARS

J.S. STAEDTLER, INC.
HACKENSACK, NEW JERSEY

Mars products are available at better engineering and drafting material suppliers everywhere.

Chains change by your choice of attachments! *If you can't find it here...*



Moline can make it for you!

To help you visualize new applications for chains, here are a few of the hundreds of Moline chain and attachment combinations which are available. Each attachment creates a new conveyor device for material handling.

If you do not see just the right chain-attachment combination, Moline has completed a brand new "Designers' Handbook" which shows all types and sizes of chain and attachment combinations, com-

plete with details on application and performance. They'll help you "spark" new ideas for your conveyor or process plant equipment. Write today for your copy.

If standard attachments are not available to meet the needs of your project application, Moline engineers will be glad to work with you on a special attachment. Write or phone for consultation and help on your problem. There's no obligation.

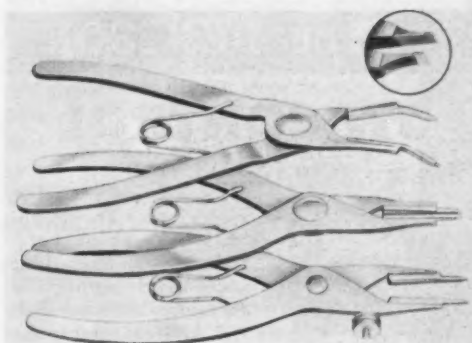
*Specializing in the
manufacture of chains*

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are located in all industrial
areas and principal cities.

Moline Chains

for conveying, elevating and power transmissions
MOLINE MALLEABLE IRON COMPANY
St. Charles, Illinois

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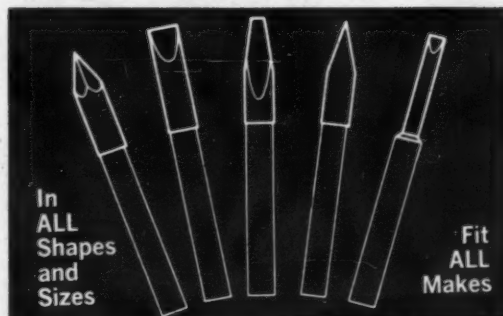


Fixed-tip plier for retaining-ring applications may be obtained with "C"-ring tips for crescent and "E"-type rings. Tools have tips which range in size from 0.022 to 0.090, including 3 straight-tip and 5 angle-tip styles. Tips are made from high-quality tool steel and straight and angle tips are undercut for greater accessibility. All tools are equipped with conventional plier springs. Snap-ring tools are made in 9 sizes, including 4 for automotive use, of alloy steel with bright chromate finish. They are available in industrial sizes with micrometer type stop; utility models are manufactured without spring or stop in both internal and external types.

Milbar Corp., 1900 Euclid Ave., Cleveland 15, Ohio.

Non-Freezing Solder Tips

367



Long-life soldering tip which does not freeze or stick meets the need of ever-increasing use of high-temperature, high-performance soldering irons. Soldering end of tip is multi-coated for long wear and shank is immunized so that solder will adhere only to working surface. This prevents solder from creeping into tip hole or dropping on components. "Durotherm" is made in diameters of $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ inch, and in large sizes of lengths, shapes and tip points.

Hexacon Electric Co., 636 W. Clay Ave., Roselle Park, N. J.

FASTENOMICS

TIPS ON FASTENER APPLICATIONS BY STANSCREW

Socket Screw Standards Changed

Check Dimensional Revisions Now to Avoid Extra Costs

Important changes are now in progress in the socket screw industry. Every user should know the details and take appropriate action to avoid higher costs in the future. As a public service, Stanscrew is issuing this progress report.

New Standards Adopted

Exhaustive industry-wide studies, begun in 1954, culminated in 1959 with the adoption of new dimensional standards for socket head cap screws. Standard Screw participated in these studies and concurred in industry recommendations. The new standards, known as the "1960 Series", include changes in head diameters, socket sizes, and thread lengths.

Advantages of New Design

The "1960 Series" has been carefully engineered so there is functional uniformity for all sizes, particularly as applied to wrenching areas and to the relationship of head diameters to body diameters. It offers these important advantages over the previous design, known as the "1936 Series":

1. Larger wrenching area permits applications of clamping force . . . provides maximum utilization of fastener's inherent strength.
2. Provides increased bearing surface under the head . . . up to 233% more.
3. Minimum indentation . . . particularly important with softer metals.

What's Available When

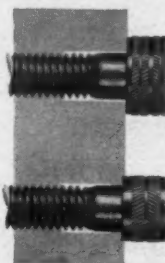
When the "1960 Series" was announced in 1959, it was believed it would become the only standard as of Jan. 1, 1961 and, thereafter, all "1936 Series" would be available only on special order. As previously announced, all sizes in the "1960 Series" are being supplied as standard. However, to make the transition as easy as possible, Stanscrew and other leading producers have extended the changeover period for certain sizes of the "1936 Series".

These are the sizes . . . $\frac{5}{16}$ ", $\frac{7}{16}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ " and 1" . . . for which the new standards include a change both in head diameter and socket width across flats. Until Jan. 1, 1963 both the "1936 Series" and "1960

Series" will be considered standard in these six sizes.

For all sizes, however, thread lengths are now being manufactured to "1960" standards. Once current inventories are depleted, "1936 Series" thread lengths will be available on special order only. Based on exhaustive surveys, this will prove no problem in the overwhelming majority of applications.

In some sizes . . . #1, #2, #4, #6, and #8 . . . head diameters are the same, but there has been a change in the socket width. In these sizes, current production is to "1960 Series" dimensions. These sizes are also available in the "1936 Series" until present stocks are depleted, but thereafter only on special order.



NEW 1960 SERIES

OLD 1936 SERIES

Change In Your Designs Essential

This industry program makes it essential that you review product designs to avoid future difficulties. All products now on your drawing boards should incorporate the "1960 Series" socket cap screws wherever possible. And, during the next two years, it is recommended you take advantage of model changes or other opportunities to change existing applications of the "1936 Series" to the "1960" standards. Failure to make provisions could result in procurement difficulties or the higher costs of non-standard items.

Complete Design Information Available

Stanscrew has prepared an up-to-date brochure giving complete information on all steps in this important transition, together with complete design data on both the "1960" and "1936 Series". You can obtain your copy through your local Stanscrew distributor. Call him today.



FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

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"PROGRAMMED PRODUCTION"



...high productivity AT **FAIRFIELD** benefits users of gears

Simple arithmetic explains why, TODAY, many of America's leading machine makers no longer undertake to solve the problems involved in production of gears, differentials, and specially designed gear parts. For them, **FAIRFIELD IS THE ANSWER!**

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Check with Fairfield NOW on your gear production schedules. As one of the nation's largest independent producers, Fairfield can usually give you quickest service available and handle any production requirement. *Become a Fairfield customer; it pays!* **CALL OR WRITE.**

FAIRFIELD MANUFACTURING CO., INC.

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Gears and Differentials



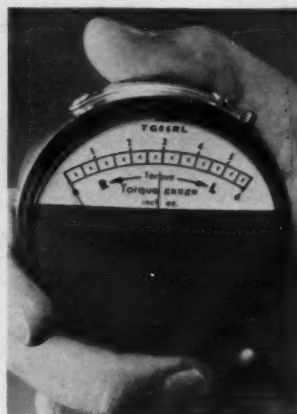
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EQUIPMENT

Torque Gage 368

A precision torque gage measures starting, stalling, and friction torques on small instruments and miniature motors. The gage permits clockwise or counterclockwise torque to be registered in the same direction on the same scale. Completely mechanical and non-magnetic, TGRL is suitable for measuring positioning servomotors, detent-type servomotors, gimbal assemblies and small gear trains. It is accurate to



± 1 percent and is available in two models: a $2\frac{3}{4}$ by $1\frac{1}{2}$ -inch, 5-oz model; and a 5 by 2-inch, $7\frac{1}{2}$ -oz model. Eight standard ranges go from 0-2 oz-in with $\frac{1}{8}$ -oz-in increments on one scale to a high of 144-216 oz-in with $\frac{1}{2}$ or 1-oz-in increments on one scale.

Torque Controls, Inc., 829 E. Broadway, San Gabriel, Calif.

Designer's Fact File from DENISON

FLOW CONTROL



New infinitely-variable, Multi-Range Flow Control solves problem of uniform feed-rate on machine tools. Precision-built in three standard sizes— $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ "—for pressures to 3,000 psi. Features: Extra-sensitive flow selection. Simple, foolproof operation. Temperature compensated. Needs no external drain. Built to JIC Standards.

Write for full details in Bulletin VFC-3.

DENISON ENGINEERING DIVISION
American Brake Shoe Co.

1190 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

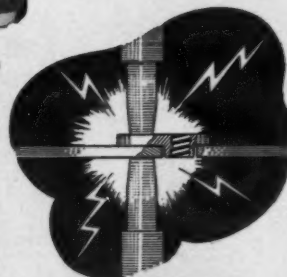


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OHIO SPOT WELDING FASTENERS



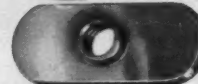
XN NUT
Thread Sizes
#6-32 to
 $\frac{3}{8}$ -16



SP PIN
Body Dia.
.117 to .335



SN NUT
Thread Sizes
#6-32 to
 $\frac{3}{8}$ -16



ND NUT
Thread Sizes
#6-32 to $\frac{3}{8}$ -16



SS SCREW
Thread Sizes
#6-32 to
 $\frac{3}{8}$ -16

If you do spotwelding you can attach OHIO Spotweld Fasteners at the same time for faster, trouble-free assembly.

Samples and information available upon request.



Primary Fastener in Fastener Assemblies

THE OHIO NUT AND BOLT CO.
29 FIRST STREET BERE A, OHIO

Circle 134 on Reader-Service Card for more information

DESIGN NEWS—FEBRUARY 13, 1961

Nameplate Kit 369

A do-it-yourself kit facilitates manufacture of etched metal parts such as nameplates, instrument dials and panels, schematics, serial numbers, labels, security badges, scales, tool checks, etched photos, and templates. The process, trade-named "Fotofoil", can produce a high-quality etched part in 7 minutes. Without skilled labor or darkroom facilities, on-the-spot production in minutes means fast, low-cost parts are readily available. From 1 to 7000 parts per day can be produced with modest equipment and utilization of little working area. The kit embraces a variety of colors.

Miller Dial & Name Plate Co.,
4400 N. Temple City Blvd., El
Monte, Calif.

Machinists' Tool Chest 370



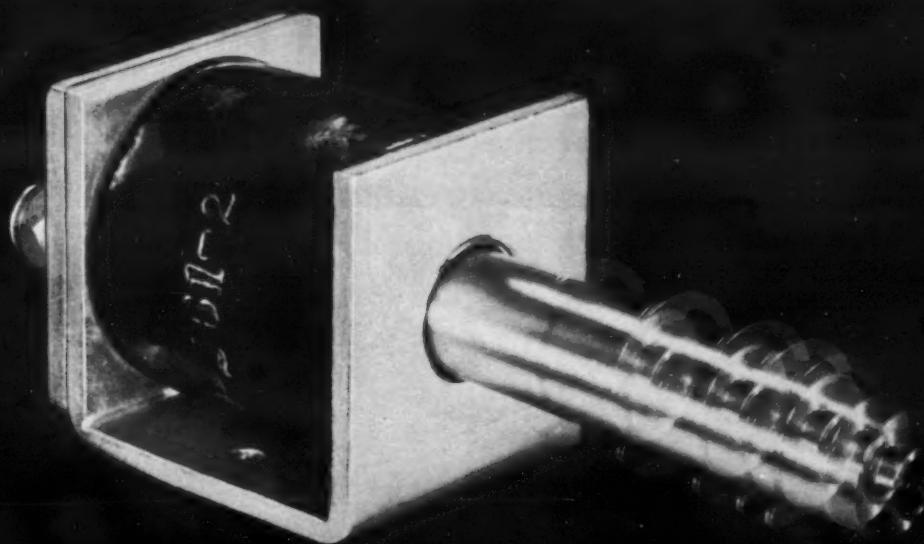
Wide enough to accommodate a 24-inch scale, $\frac{1}{4}$ inch drill and other extra-long tools, the model 526 is designed for use as a separate bench chest, or in combination with base-type companion tool box MC 28. The unit is built of heavy-gage steel and is reinforced by inside walls for maximum rigidity and solid drawer support. Drawers ride on compound slides and function smoothly even when heavily loaded. Positive stops prevent accidental pull-out and spilling. All drawers are equipped with a spring-catch device to assure trouble-free drawer removal.

Kennedy Mfg. Co., 200 Harrison St., Van Wert, Ohio.



Circle 135 on Reader-Service Card

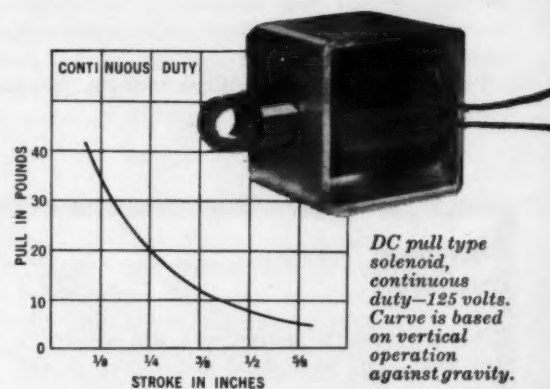
100 MILLION OPERATIONS!



new ASCO solenoid has virtually unlimited life ... outstanding economy

In this case "unlimited life" is a simple statement of fact. ASCO's new solenoid is manufactured to such precise tolerances (± 0.0005 ") that wear is virtually non-existent. In ordinary solenoids, the plunger rides loosely in the sleeve—inviting wear. But in ASCO's long-life solenoid, the plunger is guided by a machine tool bearing that assures accurate stroking and reduces friction to an absolute minimum.

Because this solenoid was engineered with quality as the prime consideration, its initial cost is higher. However, it is in fact *the most economical solenoid you can buy* because, once installed, it can practically be forgotten. This solenoid will still be functioning 100 million operations later—long after standard types have been replaced—and replaced—and replaced. For additional information, contact your ASCO engineer or write for Catalog 57-S5.



ASCO Electromagnetic Control

Automatic Switch Co. 56D HANOVER RD., FLORHAM PARK, N. J., FRONTIER 7-4600
AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

ASCO

EQUIPMENT

Vertical File System

371



A single-sheet hanger, made of heavy-duty press board with a self-adhesive strip applied, is offered in 18 and 36-inch sizes. Adjustable rack is available that will accommodate 150 hangers of any length up to 36 inches. Intended for single sheets—envelopes, artwork, vellums-tracings, and almost any large sheet material—vertical filing is accomplished with use of this self-adhesive hanger. Pre-drilled holes permit groups of hangers to be fastened together with ordinary $\frac{1}{8}$ inch paper fasteners. Tracings and vellums can be reproduced with sheet hanger attached.

Plan Hold Corp., 5204 Chakemco St., South Gate, Calif.

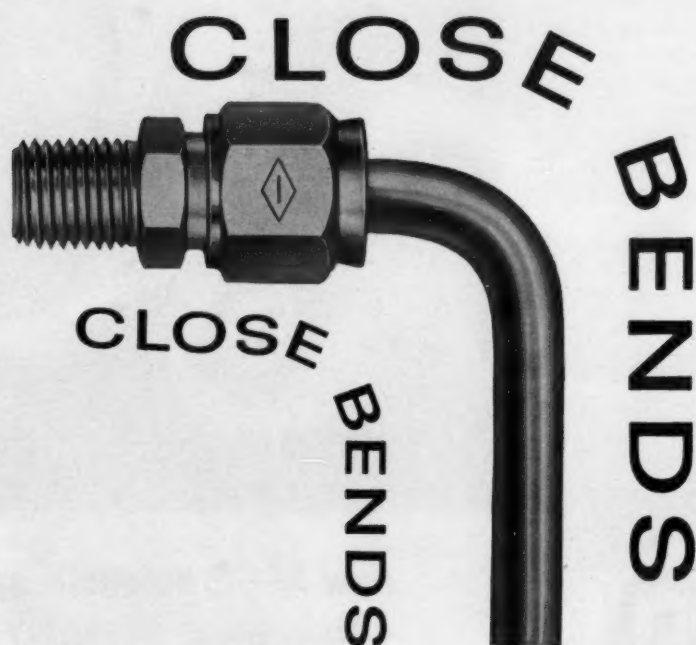
Universal Drive Tensioner

372

Exact tensioning is assured with this tensioner's arm which can be rotated and locked in any position on a 360-deg arc. A 2-inch long interchangeable shaft is supplied with each tensioner and 3 or 4-inch long shafts are supplied for multiple width drives. Bronzed bushed sprocket and pulley idlers to fit unit are available in 14 standard sizes.

Brewer Machine & Gear Co., 1441 N. Second St., St. Louis, Mo.

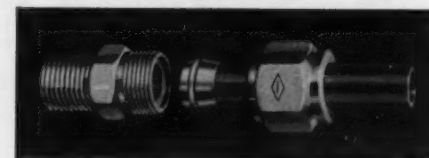
no
problems
with...



With Hi-Seal® fittings you can make tube bends close to the fitting—in fact, right next to it. Here Hi-Seal is in a class by itself.

Hi-Seal's simplified design with flareless butt joint makes this possible. The advantages? More compact layouts. Save on tubing. Shorten installation time by as much as 50%. Gain utmost reliability. SAVE MONEY. To get these advantages, insist on Hi-Seal.

For complete information, write for Bulletin 3108.



BUTT JOINT

HI-SEAL

IMPERIAL EASTMAN
Imperial-Eastman Corporation General Offices: 6300 West Howard Street, Chicago 48, Illinois

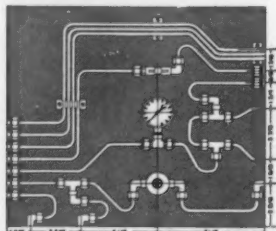
In Canada: Imperial-Eastman Corporation (Canada) Ltd., Toronto

Circle 136 on Reader-Service Card for more information

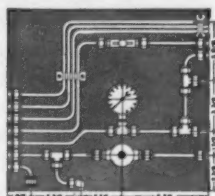
DESIGN NEWS—FEBRUARY 13, 1961

Close Bends with Hi-Seal Save Time, Space, Tubing

Look at what you can do when you use Hi-Seal fittings:



This typical layout has "old-fashioned" tube fittings. Layout area, 257 sq. in.; 12.7 ft. of tubing; installation time 2 hr., 34 min.



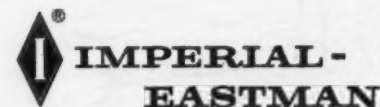
Same layout with Hi-Seal tube fittings. Layout area reduced 32% to 175 sq. in.; tubing reduced 40% to 7.7 ft.; installation time reduced nearly 50% to 1 hr., 20 min.!

All this is possible because of Hi-Seal's exclusive flareless, butt joint design. This means that tube bends may be made right next to the fittings. Even direct tube connections may be made without any extra loops to allow for tube entry into the fitting.

One Fitting for the Entire System
However varied your requirements may be, Hi-Seal meets them. Available in all styles, sizes and combinations, plus a variety of metals: steel, stainless steel, brass, aluminum, titanium, Monel, etc.

Now Imperial-Eastman meets all your requirements for hydraulic-pneumatic-flow system components: tube fittings, valves, couplings, flexible and rigid hydraulic and pneumatic hose, thermoplastic tubing, tubing tools.

FITTINGS



Circle 193 on Reader-Service Card

DESIGN NEWS—FEBRUARY 13, 1961

Magnetic Lamp Holder

373



A lamp-holding device, utilizing a powerful V-magnet, features adjustable ball-swivel clamp, making the product adaptable for use with practically all makes of trouble lights. The permanent magnet, which has a 45-lb holding pull, is cast in an impervious epoxy resin. The unit acts as a third hand for holding a light where it is needed—under the hood, dashboard, fender or on frame of a car. The handyman will also find many other uses for the "Versa-Magnet" around shop or garage.

Standard Portable Cord Co., Inc., Mayville, N. Y.

Outward Clinch Stapler

374



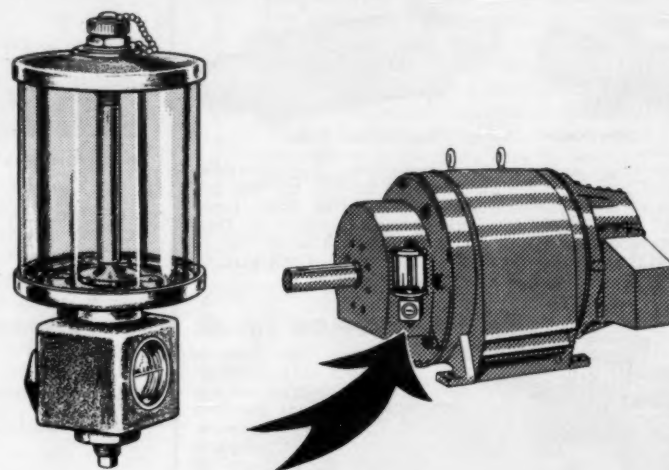
This unit diverts the staple legs outward and upward as it is driven, without the use of any metal plate or anvil beneath tool. This improvement consists of an adjustment device which enables user to control amount of curl of staple to compensate for wear after long usage. Stapler is used to attach inventory tickets and various shipping tags to filled corrugated cartons, and for attaching insulation wrappings around air ducts.

Fastener Corp., 3702 River Rd., Franklin Park, Ill.

New Ideas From Oil-Rite

... to solve your lubrication problems

Are you looking for low cost Oilers — automatic lubricating systems — special lubricators, systems or components — ways to reduce costs? You will find the answer in the Oil-Rite line — complete with engineering service.



HERE'S A SAMPLE

A manufacturer of large electric motors wanted visual proof of proper oil level within a device which continuously replenishes oil as used by bearings. Oil-Rite suggested this lubricator with

a large sight in base for easy visual check of oil level. It also includes a top filler cap — an exclusive Oil-Rite feature on all constant level lubricators.

Consult us on your requirements for lubricating equipment. Specific information will be furnished promptly to help you select suitable equipment, adapted for your individual application. Benefit from our 25 years of accumulated knowledge and skill in this field. There is no obligation.

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REPUBLIC
VALVES
FOR EVERY INDUSTRY

CHECKS

THAT FILL YOUR NEEDS

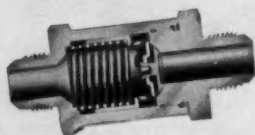
MINIATURE CHECKS



Mini-Valve

Regular Size Valve

Save weight and space with Mini-Valves. They have same rated flow as regular size, but are only $\frac{1}{4}$ the size and weight. Good pressure drop characteristics. Temp. range -65° to plus 400°F . Operating pressure to 5000 psi. One-piece stainless steel body, in tube sizes 4 to 16 ($\frac{1}{4}$ " to 1" O.D.) Meets or exceeds requirements of MS MIL-V-25675. Port threading MS33514 flareless.



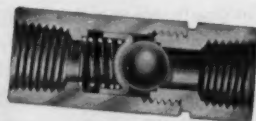
FREE-FLOW CHECKS

Extremely low pressure drop, with wide open flow. Molded elastomer seal and spherical seat prevent leakage at any pressure. Sizes $\frac{1}{8}$ " to 2" in brass and aluminum alloy up to 3000 psi, and stainless steel to 4000 psi. Opens at 2 psi. Temp. range -65° to 200°F . Pipe, internal straight thread and flared tube connections standard; MS33514 flareless available.

3000 psi, and stainless steel to 4000 psi. Opens at 2 psi. Temp. range -65° to 200°F . Pipe, internal straight thread and flared tube connections standard; MS33514 flareless available.

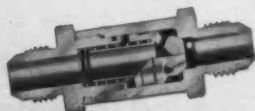
BALL CHECKS

Ruggedly constructed for intermittent non-shock hydraulic service up to 500 psi at temperatures -65° to 350°F . Sizes $\frac{1}{8}$ " to $\frac{1}{4}$ ". Brass, aluminum alloy, stainless steel. Pipe and flared tube connections.



HY-PRESSURE CHECKS

Built for continuous service in high velocity systems at pressures up to 5000 psi in steel and stainless steel, and 3000 psi in aluminum alloy. Low pressure drop. Metal-to-metal seal. Operating temperatures -65° to 250°F . Sizes $\frac{1}{8}$ " to 2", with pipe, internal straight thread and flared tube connections. MS33514 flareless available.



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DESIGN DESIGN IDEAS NEWS

MATERIALS APPLICATIONS

Plastic Shut-Off Unit Meters through Four-Step Reducer

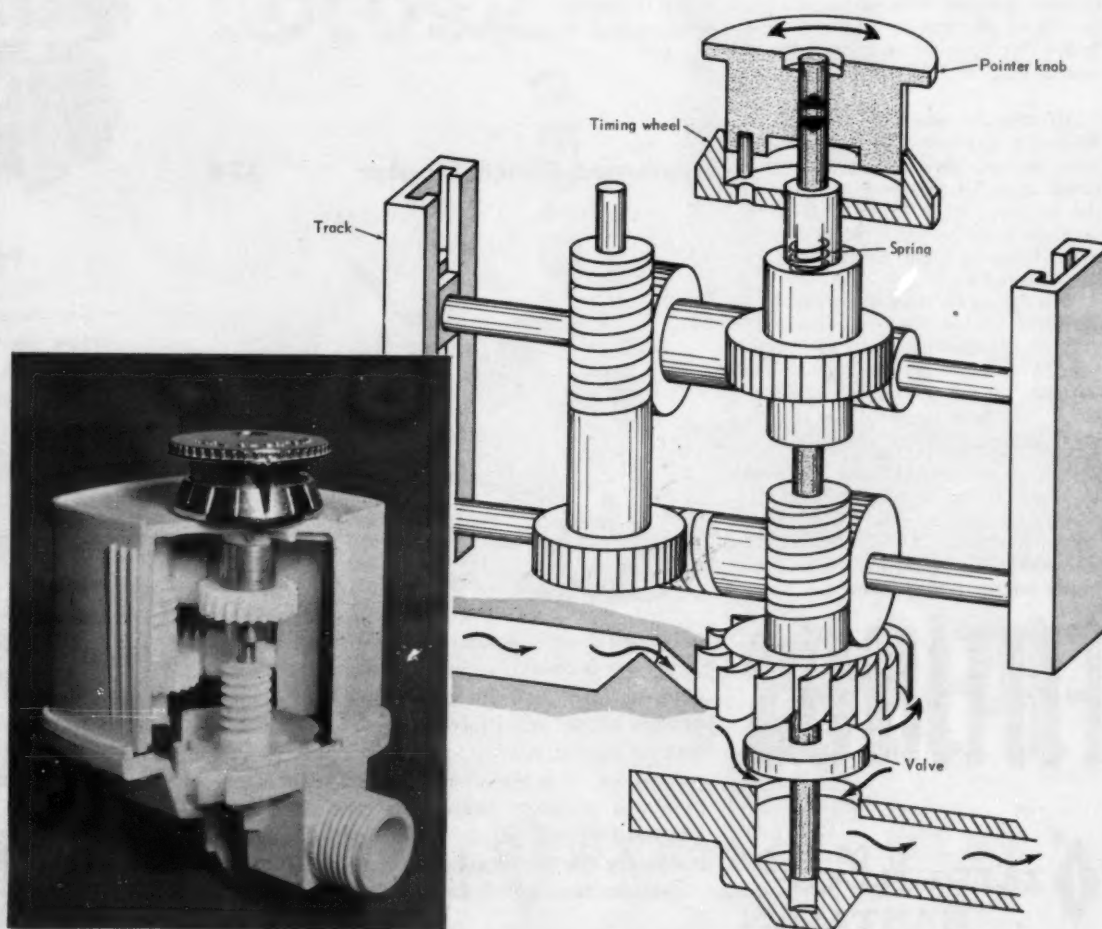
Lars G. Soderholm, Midwest Editor

An interesting plastic automatic shut-off control unit designed for use with lawn sprinklers operates on the principle of a water meter and measures water volume through a four-step worm gear reducer. A movable valve plunger is held by a calibrated dial at the low-speed end of the speed reducer until the required volume of water is passed. At that time the plunger drops down to the valve seat, stopping the flow of water.

The housing of the shut-off control unit is made of "Cyclocac" plastic. For assembling convenience, the molded case is provided with internal tracks in

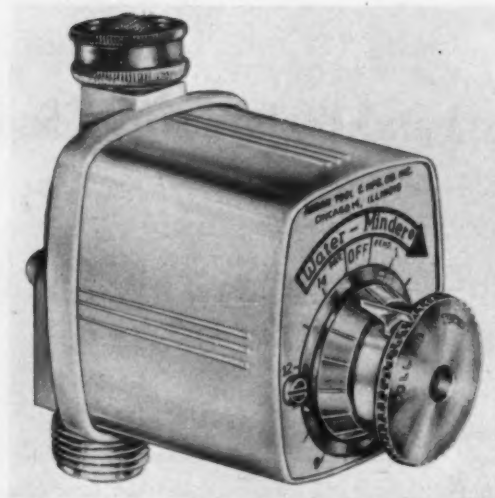
which the "Delrin" reduction gears are placed. The two horizontal reduction gear assemblies are held in bearing end-plates which drop vertically into position in the molded tracks. The vertical reduction gears are placed in the housing next and are held securely when the cover is fastened into position.

Water from the user's sillcock goes into the shut-off control through an orifice which increases the fluid velocity and also directs it at an angle to the vanes of a "Delrin" water wheel. The rotation of the water wheel passes through four sets of "Delrin" worm and gear reducers each having a 24:1 reduc-



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DESIGN NEWS—FEBRUARY 13, 1961



tion ratio. The total reduction through this system is 331,776 to 1. At the end of the gear train is a timing wheel with a series of holes around its outside edge.

To set the automatic shut-off control unit into operation, the pointer knob is lifted and turned to one of the graduations on the gallon dial. A pin in the pointer knob fits in one of the holes on the timing wheel. After the required volume of water has been passed, the timing wheel passes over a slot in the "Cyclocac" housing at which point the pin in the pointer knob can drop through the hole in the timing wheel.

When the pointer knob is lifted to set desired gallonage, the plunger is lifted simultaneously off its valve seat. It is held until the pin in the pointer knob drops through the hole on the timing wheel. The plunger closes the valve as the required amount of water has been metered. A small compression spring aids the plunger in its initial seating movement, but after that, water pressure tends to hold the plunger closed.

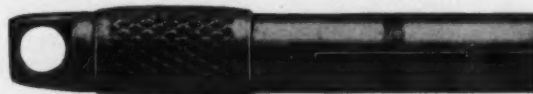
Because of the principle under which this shut-off control operates, varying water pressure does not appreciably affect its metering ability. A drop in pressure only increases the time required to get the dialed quantity of water on the lawn.

The metal shaft (for the plunger) and the compression spring are both made of stainless steel. O-ring seals are used to isolate the internal components from the die-cast, chrome-plated control knob components. All parts are corrosion-resistant. Maximum delivery at any one time is 1400 gallons.

The "Water-Minder" automatic shut-off control was designed by the Eastgate Engineering Co., Chicago, Ill., and is manufactured by Ansan Tool & Mfg. Co., also of Chicago.

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BERYLCO INSPIRES NEW DESIGN THINKING



3½ times actual size



Electrical connector of beryllium copper rod: By selecting a Berylco alloy, the designer met requirements for high conductivity, corrosion resistance, high contact force, and excellent resistance to creep. The connector also has enough yield strength to permit mis-alignment of the mating connector without loss of electrical contact. It is usable up to 300°F. Lead-in wires can be soft-soldered to the connector.

New advances in critical parts performance now possible The ever-widening and increasingly successful use of Berylco beryllium copper alloys is opening a whole new area of design thinking on parts. The list of attributes in this amazing alloy reads like a Who's Who of famous performance characteristics: good conductivity, high fatigue strength, non-magnetic, high strength, unusual wear resistance, resistance to anelastic behavior, good corrosion resistance, excellent hardness, wide operating temperature range. Find out what these characteristics can mean to the parts you are now working on. Write for our latest BERYLLIUM COPPER BULLETIN. To assist you further, an experienced, knowledgeable staff of field and mill technicians stand ready to translate design possibilities into performance realities.



THE BERYLLIUM CORPORATION
Reading, Pennsylvania

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Bearing race cast from beryllium copper ingot: The choice of Berylco alloy on this investment casting was easily made because its high fluidity provides good surface, close tolerances, excellent detail and the ability to cast thin sections. When added to the advantages of the alloy itself, like high strength and good wear resistance, it becomes easy to see why beryllium copper is being used more and more in several casting methods.



Bellows of beryllium copper strip: The design engineer on this part knows a Berylco alloy is a fine choice because its low modulus of elasticity (approx. 18.5×10^6) gives greater deflection for a given pressure change than other high strength alloys. And it has good fatigue strength with a yield strength that gives excellent usable movement range.



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HYDRAULIC EQUIPMENT

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With the aid of equipment like this, new designs, new techniques, new concepts of hydraulic application are being constantly created at Hydreco. No wonder Hydreco engineers are maintaining performance and reliability standards unsurpassed in the field of hydraulic components.

If you build construction equipment or machines for agriculture and industry, keep these unique facilities in mind. *Remember, it's one more way Hydreco serves you better!*

IDEAS . . . MATERIALS APPLICATIONS

Projection Welding

E. J. Stefanides, Central States Editor



In redesigning the electric shift-lever of a two-speed, industrial-truck axle, it was decided to use a projection-welding method to join the component parts. The assembly consists of an "L"-shaped stamped piece to which a machined hub and actuating pin are attached. The use of projection welding was prompted by several important considerations.

Both the hub and actuating pin are subjected to relatively heavy loads. The brazed joints of the original design were calculated to give adequate strength for these loads; however, preliminary road tests showed that unpredictable operating stresses could loosen them.

Furnace brazing had been selected originally because it was thought to be the most economical method for volume production. In searching for a better joining method, it was essential that the cost of the redesigned lever be competitive with the furnace-brazed units.

Finally, it was necessary to maintain good alignment between cylindrical hub and closed end of stamping, provide a close tolerance on the hub inside diameter and smooth bearing surfaces at bases of hub and actuating pin.

The projection-welded lever met all these requirements. It also resulted in a substantial reduction in overall cost of the lever assembly. The redesign was achieved with only minor modification to existing hub and actuating-pin parts and with inexpensive tooling requirements. The most difficult part of the redesign was establishment of the exact part contour and the precise operational parameters needed to assure a consistently sound weld.

The engineering of the welding process was done by the Spotweld Div. of the Otto Konigslow Mfg. Co., Cleveland, Ohio. The axle assembly in which the lever is used was designed and is manufactured by the Axle Div. of Eaton Mfg. Co., Cleveland, Ohio.



PUMPS



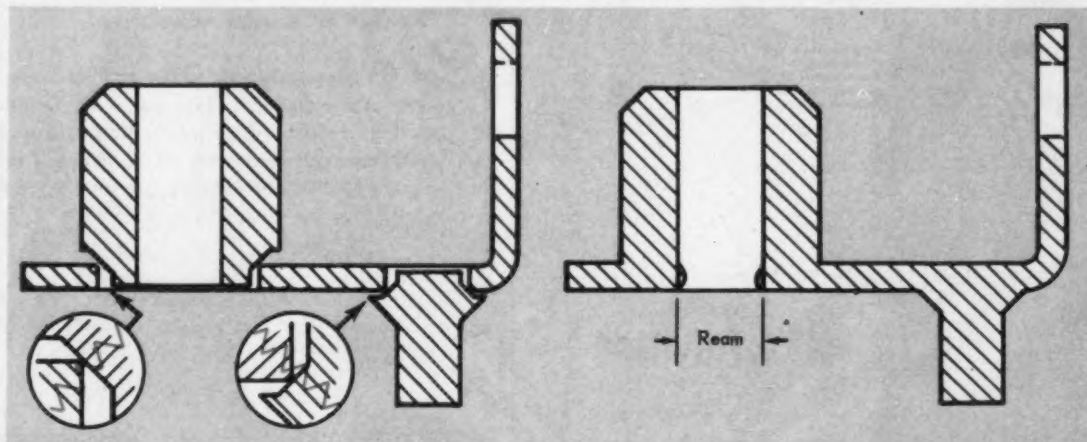
VALVES



MOTORS

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Increases Strength, Cuts Cost of Lever Redesign



MODIFICATION REQUIRED for conversion from brazing to projection-welding method was minor. It consisted of lengthening shoulders which fit into stamping and adding chamfers or fillets at inside corner of shoulders. Electrical resistance required for welding process is provided by line

contact between tapered fillets and rims of holes in stamped piece. Only additional operation required after welding is reaming to tolerance of hub inside diameter. This is required because of mushrooming effect caused by forging pressure.



ringside view of United's
exclusive feature for

**Pressure
Tight Seals**

United's exclusive, patented[®] self-energized metallic O-rings are circular tubes vented by tiny holes drilled in the ring wall. The holes allow contained pressure to enter the ring which then forces ring wall to form positive pressure-tight seals under high pressure.

In metal-to-metal applications, self-energized metallic O-rings are capable of forming positive, permanent, non-corrosive static seals under extreme temperatures from -321°F. to 1800°F., and under pressures equal to ultimate compression stress of the metal itself. Available in various metals and finishes, 3/4" dia. to any size or configuration. United also makes non-vented and pressure-filled O-rings; and wire and brazing O-rings. Write for free 22-page booklet (on your letterhead please).

PATENTS 2,809,289; *2,837,360

UNITED METALLIC "O" RINGS
manufactured by
United Aircraft Products, Inc.
Box 1035 • Dayton, Ohio

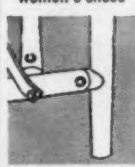
Use it for laminating... SEL-LOK spring pin



Tool handle



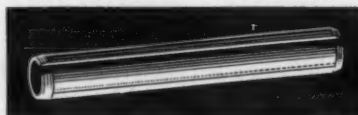
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Metal table legs

- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from 1/16 x 3/16 through 1/2 x 5 in.) and beryllium copper (1/16 x 3/16 through 1/4 x 3 1/2 in.). See your SPS distributor or write for Bulletin 2331.



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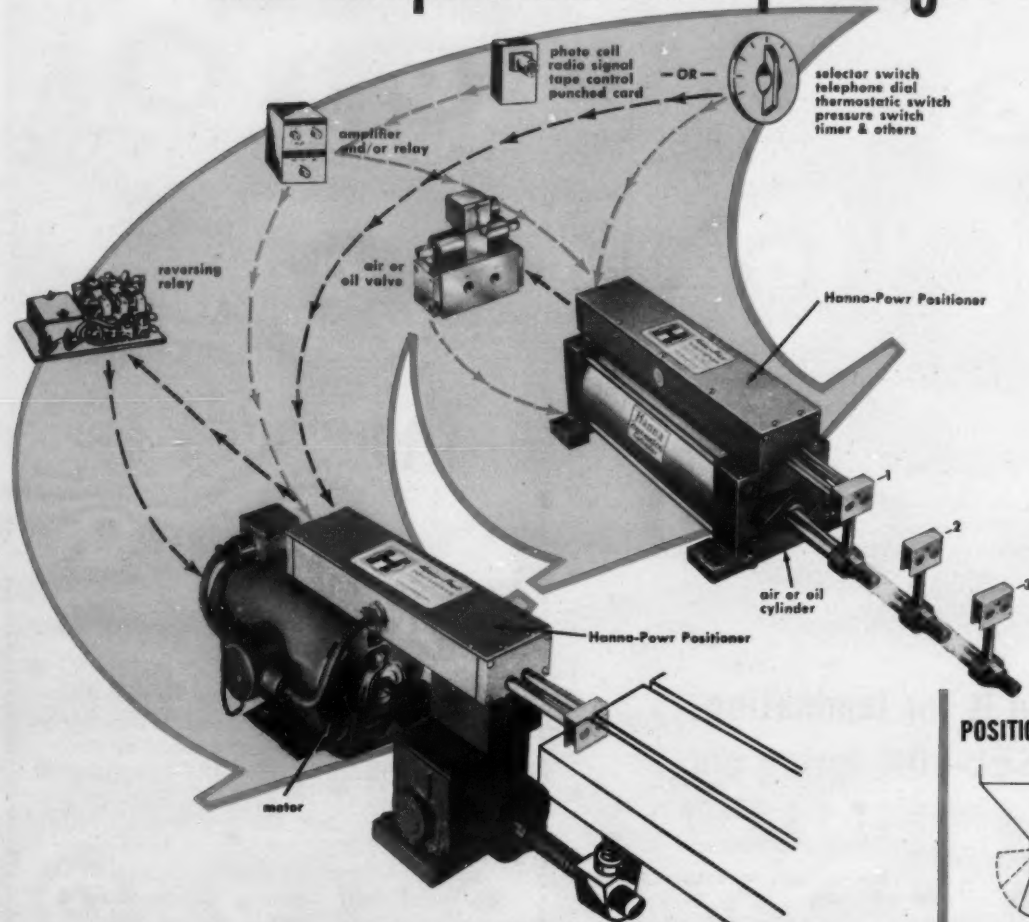
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BRAND NEW IDEA... multiple positioning in a simple, low cost package!



HANNA-POWR® POSITIONERS

THE NEW HANNA-POWR POSITIONER is a simplified, low-cost servo-mechanism used with air or hydraulic cylinders, electro-mechanical or other power drives to responsively achieve predetermined positions. The POSITIONER will also feed a signal to a read-out station to indicate the position point. Controls, such as selector switches, timers, thermostatic switches and others, feed signals to the POSITIONER for station selection—as many as 14 per foot of stroke. Infinite variations in positions are possible by simple movement of the adjustable limit switches.

Stroke lengths may vary from a few inches to several feet to suit each application.

HANNA-POWR POSITIONERS save the time of designing special controls and cams, offer convenience of installation with one simple mounting for a group of controls, and cut maintenance costs by protecting all controls in a sturdy, dust-tight housing.

Your individual problems will suggest many uses for the HANNA-POWR POSITIONER. For more detailed information call your nearby Hanna Representative, (See "Cylinders" in the yellow pages), or write us for Catalog 500.

60 Years' Experience In Building The Finest Cylinders, Valves and Other Hydraulic and Pneumatic Equipment

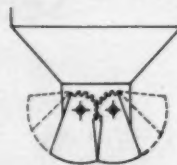


Hanna Engineering Works

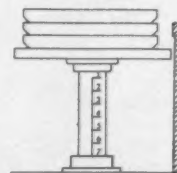
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POSITIONED POWER



GATE POSITIONING



MULTIPLE POSITIONING OF LOADS



INDEXING

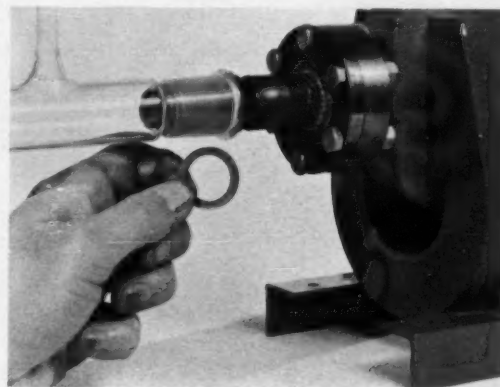
IDEAS... MATERIALS APPLICATIONS

Metal Alloy Coats

Edward W. Schrader, Western Editor

An alloy containing nickel, silver and lead gives durability to a metal seal. The seal is serviceable in the temperature range of -320°F through 600°F and has been tested up to 22,500-psi pressure. Tests results show a longer life for the alloy coating than for the same seal with "Teflon" coating.

The alloy makes a metal-to-metal seal with the mating surface, the latter with finishes of 64



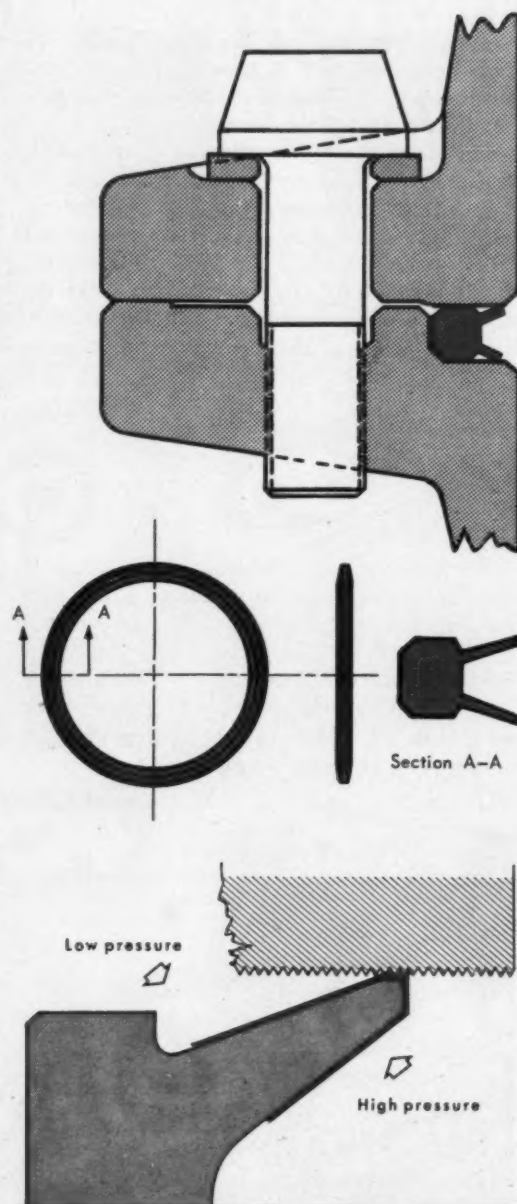
ION PUMP uses alloy-coated seal for vacuums of 1×10^{-9} mm of mercury. The metal seal does not volatilize at these low pressures.

microinches (RMS). Most other metal platings, such as silver, require a finer finish to effect a leak-tight seal. The seal is reusable approximately 15 times, assuming reasonable care in handling.

The base metal of the seal is either 304 or 17-4 PH stainless steel. The alloy coating can be applied by a modified electroplating technique or deposited by electrophoresis. The sealing property of the alloy is acquired by its ability to fill the surface irregularities. Thus, it also provides lubrication during assembly.

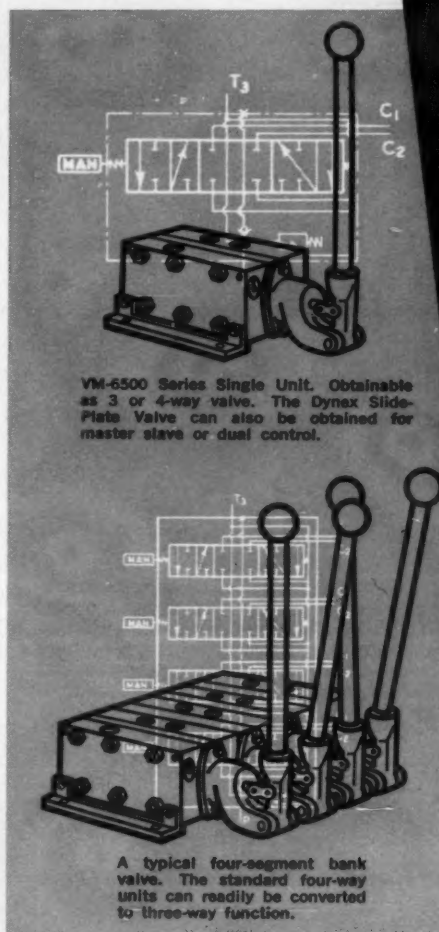
The K6 Alloy is a development of Harrison Mfg. Co., Burbank, Calif. The alloy is applied to its metallic K seals.

Seal for Durability



ALLOY COATING fills in surface irregularities. Plating is 0.0007 to 0.001 inch thick. Seal lip makes theoretical line contact. Clamping compression stress in seal causes seal lip to crush to area width of 0.001 to 0.002 inch wide. Radial closure force on seal lip is assisted by differential pressure across seal. Open side of K is exposed to high-pressure side. Seals are made in sizes from 0.250- to 1.000-inch O. D.

individually
or
in banks



VM-6500 Series Single Unit. Obtainable as 3 or 4-way valve. The Dynex Slide-Plate Valve can also be obtained for master slave or dual control.

A typical four-segment bank valve. The standard four-way units can readily be converted to three-way function.

DYNEX VM-6500 SERIES DIRECTIONAL CONTROL VALVES PROVIDE

precise control . . . infinite versatility

For efficient machinery as well as for mobile equipment — the Dynex slide-plate directional control valve offers interesting potential. It exceeds the metering and load-holding advantages of conventional valve designs — and adds new ease and precision of operation to high-pressure systems. Available as an individual unit. Or in banks of up to six segments, as standard units. Other configurations are available.

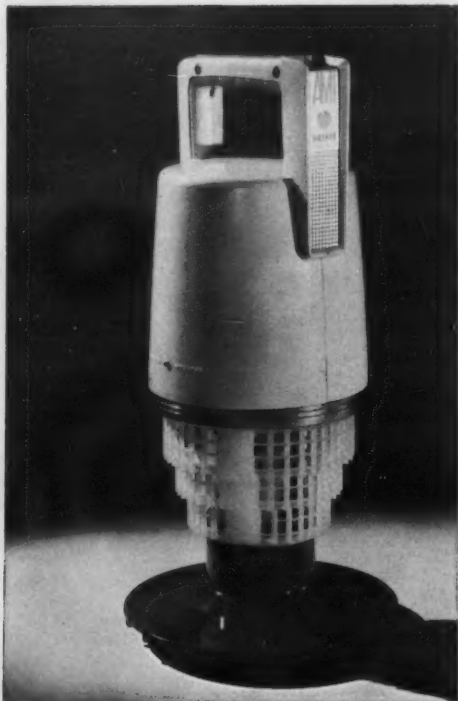
What's the secret of this unique valve? Simplicity. Its design is based on principles commonly applied to steam engine valves. A sliding plate directs the flow through appropriate orifices. Prevents "sticking" or "jumping." Permits fine metering, regeneration. Minimum clearance flow. Meets the strictest load-holding requirements.

Though the VM-6500 series valve design is simple, it lends itself well to hundreds of combinations. With only slight alterations, the basic design is compatible with practically every high-pressure circuit variation. Three-way, four-way, optional center positions, integral check and relief valves, individual valves, or banked segments. Drawing on these available characteristics, Dynex can supply "just what the designer ordered."

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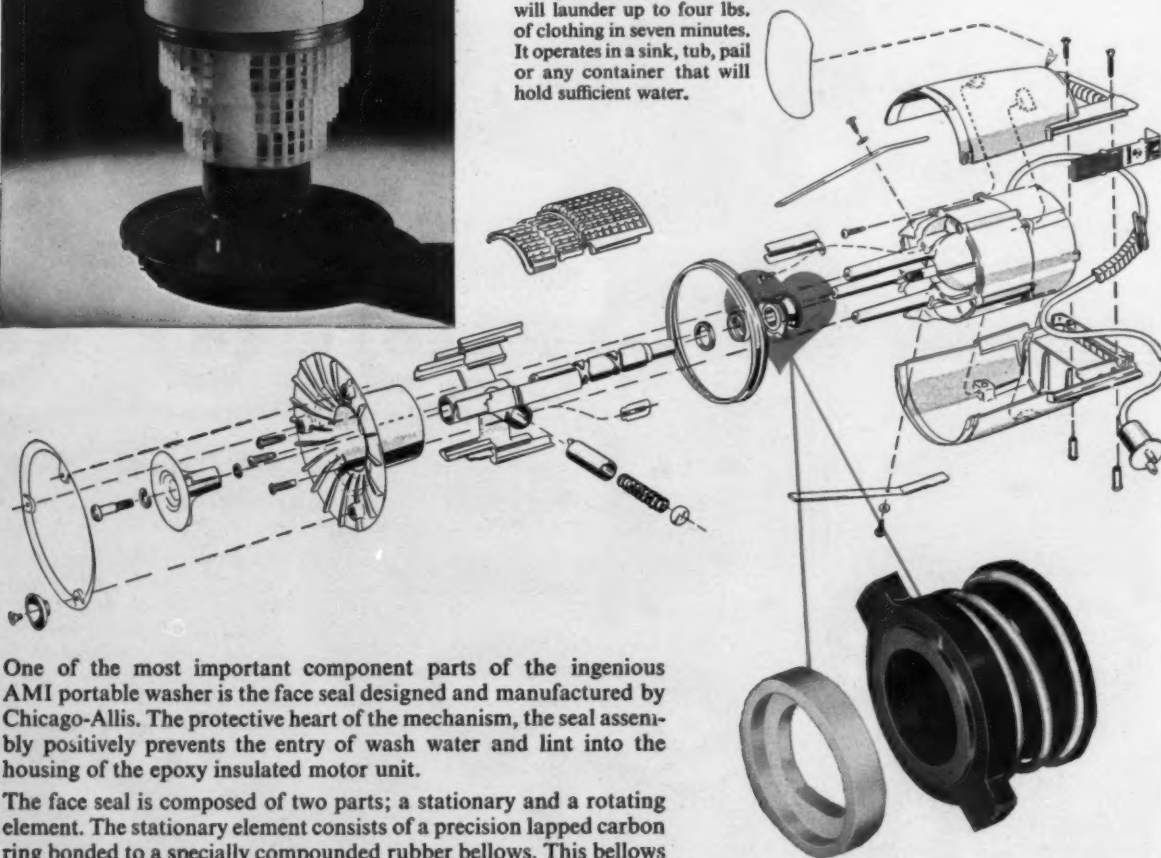
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IDEAS . . . MATERIALS APPLICATIONS

Deformation of Steel Strapping

E. J. Stefanides, Central States Editor

New equipment for rail shipment of tin plate coils uses a new type of load restrainer in conjunction with an unusual floating cover to protect the lading against damage.

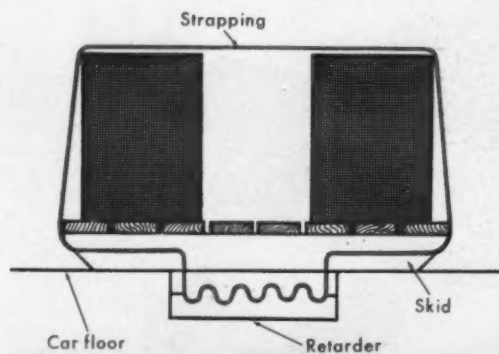
The load control retarders are a permanent part of the car and are mounted flush with the floor, welded to the underframe. During loading, standard steel strapping is threaded through the retarders, looped about the load and tightened. As the load shifts under impact, it drags the strapping through the retarder, between the meshing corrugations of the cast steel retarder guide plates. These corrugations deform the strap, producing the resistive force which brakes the load. So effective is this retarding action that one retarder working on a single 2- by 0.050-inch steel strapping has satisfactorily restrained two 16,000-lb coils under coupling impacts at speeds over 11 mph.

The effectiveness of the retarders in absorbing the shock forces produced by impact has allowed the use of a lightweight, full-floating, weather-protection cover. This cover is shaped to fit the contour of the coil load and is equipped with a wheel roller undercarriage which allows it to move with the load. Being full floating and thus



SEVENTY-TON FLAT CAR FOR TIN MILL COILS is equipped with with load-control retarders and hinged covers. Retarders reduce magnitude of shock loads by increasing time for absorption of load's kinetic energy. Cover moves with load, which is capable of four-ft controlled movement in either direction.

Controls Movement of Loads

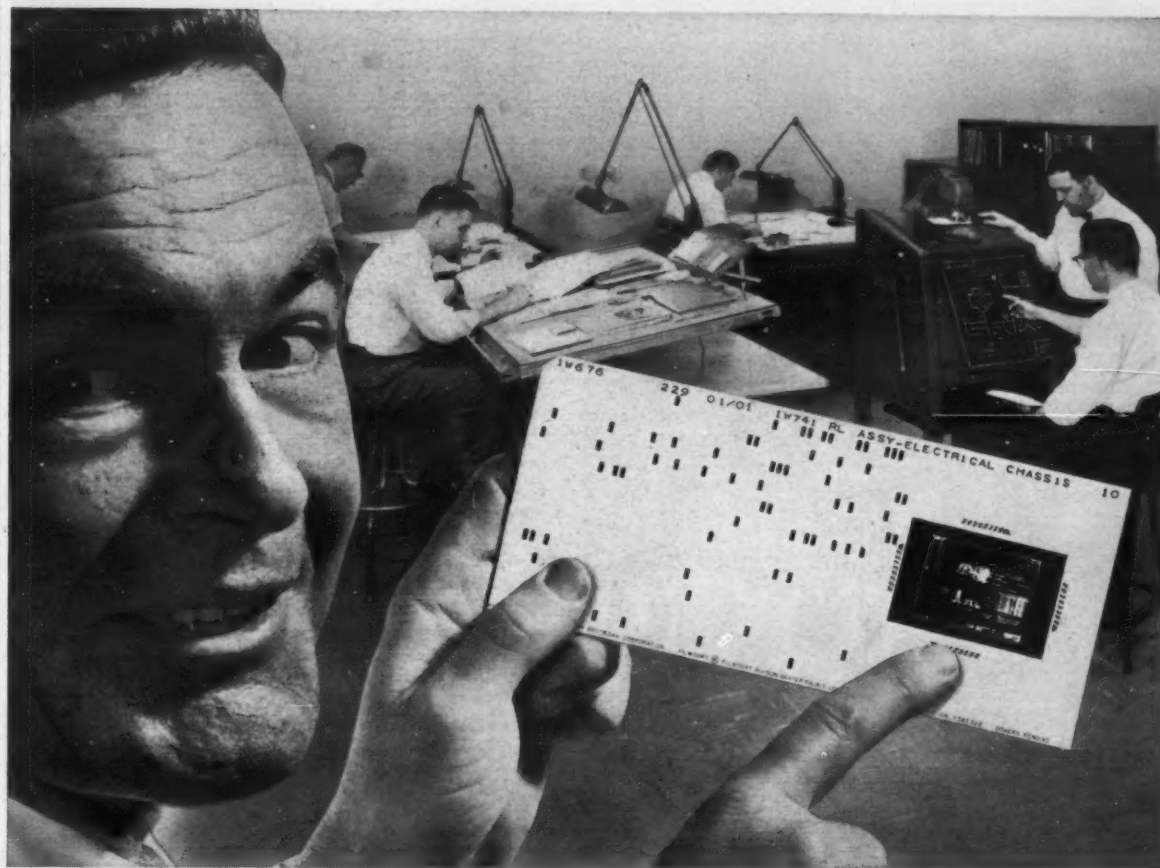


CAST STEEL RETARDER COVER is hinged to permit easy insertion of steel strapping band. When cover is closed, corrugated surface in cover and body deform band. During impact, load drags strap through retarder. Resistive force produced by deforming band restrains movement of load.

only lightly stressed, it is of the lightest, most economical construction. The front section of the cover and one-half of the roof are hinged and counter-balanced by a spring. It is easily moved out of the way manually to allow convenient loading and unloading of the car, by either fork lift truck or overhead crane.

The greatest advantage resulting from the use of the cover and retarders is the simplified loading and unloading procedures that it allows.

Both the hinged cover and load controlled retarder were developed by The United States Steel Corp., Pittsburgh, Pa. They were designed by W. G. Nichol, Assistant to Vice President of the United States Steel Central Operations.



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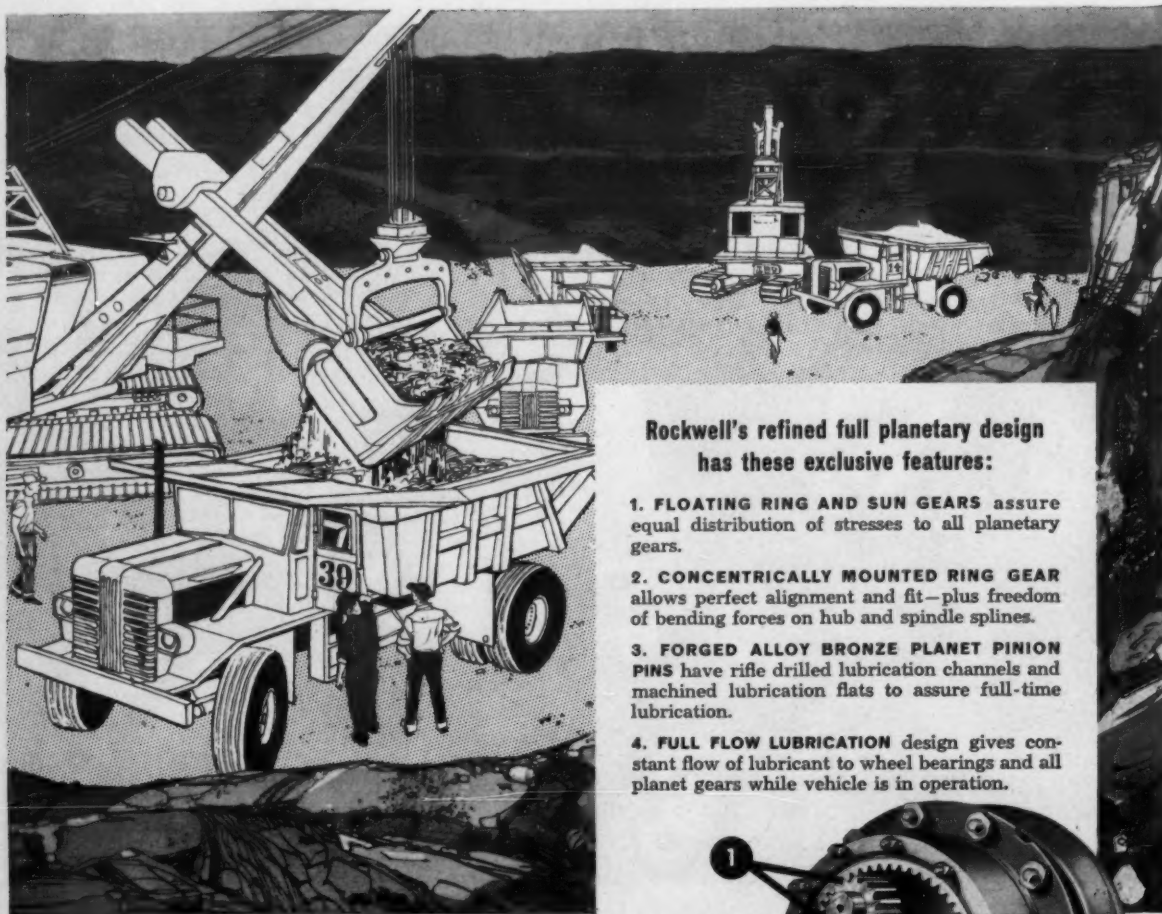
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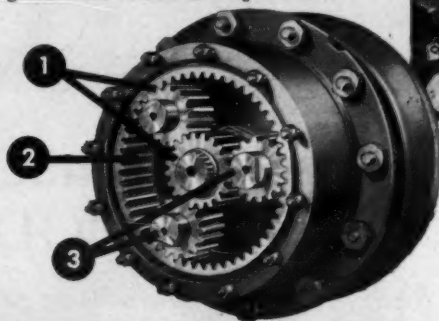
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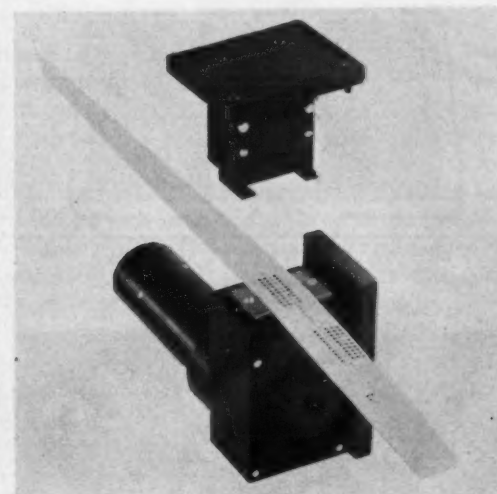
Transmission and Axle Division, Detroit 32, Michigan

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IDEAS... MATERIALS APPLICATIONS

Crossed 'Lucite'

Edward W. Schrader, Western Editor



"Lucite" lenses form astigmatic images in an optical read head. The head was developed for improved signal-to-noise ratio over existing systems using perforated paper tape as the memory.

"Lucite" has excellent optical properties. It is easy to machine or mold for lens curvature.

The optical system forms rectangular light images. These spots are 0.020 by 0.040 inch, one for each hole in a 9-channel punched paper tape. A second optical system, directly above the paper tape, reshapes the light beams into square cross-section and directs them into individual photo diode cells.

Scattered light, which is out of focus, is barely detected. For oiled pink tape, a condition where the paper is most translucent, a signal-to-noise ratio of 22:1 is achieved.

Voltage for no-hole condition is 2.0 average. Open-hole voltage is 44.0 average. In the signal-to-noise ratio tests, the voltage measurements were made across a 200K-ohm impedance with a vacuum tube voltmeter probe of 10-megohm impedance. A 6v bias was employed to reduce the "dark" voltage to zero.

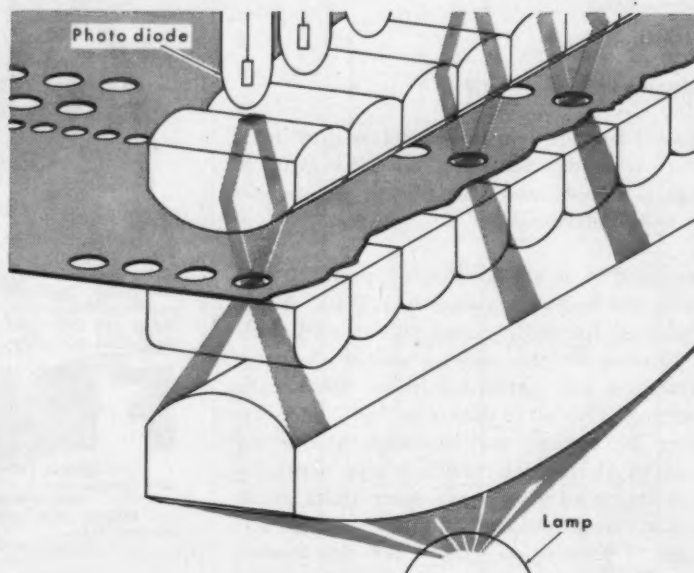
A 10v tungsten lamp filament serves as the light source. The filament is bright red with maximum energy in the near infrared region. The system performs on 70 percent filament voltage, thus giving long life.

The optical read head is a design development of PAR Products Corp., Santa Monica, Calif.

Cylindrical Lenses Produce Rectangular Images

MECHANICAL CLOCK OFFSET HOLE SYSTEM can be provided for clock signals. These electric clock signals lead bit hole signals on tape. Read head is used in computer applications with maximum reading speed of 10,000 characters per second, including time base.

FOR 9-CHANNEL PAPER TAPE, there are 19 lenses. Voltage output of photo diode approximates square wave d-c pulse for each hole conditioned in tape.



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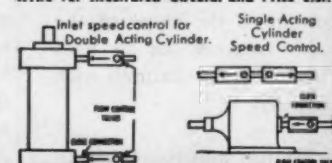
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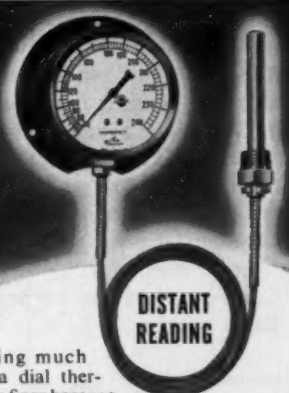
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115

Flow in Pipes and Irregularly Shaped Channels

Manning's Formula

J. P. Messina, Engineer, Pump Engineering Dept., Worthington Corp., Harrison, N. J.

This nomogram can be used to determine flow and friction loss in either pipes or irregularly shaped channels. Friction loss in pressure pipes is synonymous with hydraulic gradient in uniform open channels. The hydraulic gradient of an open channel is the slope of the free liquid surface. In the reach of a channel where the flow is uniform, the hydraulic gradient is parallel to the slope of the channel bottom. Thus, this formula can be used for either pipes flowing full or open channels with uniform flow (constant depth).

The dimensions of the conduit and liquid depth must be expressed as a hydraulic radius in feet which is equal to the liquid area divided by the wetted perimeter. (Example: A 10-ft wide, 6-ft deep channel flowing $\frac{3}{4}$ full has a hydraulic radius of $(4)(10)/(4 + 10 + 4) = 2.22$ ft). Common pipe diameters are indicated along the hydraulic radius and area scales of the nomogram so that these values need not be computed for flow problems dealing with full pipes. The material and roughness of the conduit must be taken into consideration. Determine roughness coefficient "n" from the table below. The magnitude of "n" increases with roughness.

Smooth pipes (brass, glass)	0.009 to 0.013
Commercial pipes (iron, steel, clay)	0.012 to 0.015
Concrete pipes and channels	0.010 to 0.016
Earth canals	0.017 to 0.025

Nomenclature:

- V = average velocity, fps.
- n = coefficient of roughness.
- S = slope of hydraulic gradient which is friction loss in a pipe or slope of channel bottom in ft per 100 ft. Slopes of large pipes and channels are usually expressed in ft per 1000 ft and should be divided by 10.
- r = hydraulic radius, ft.
- A = area of liquid in conduit, sq ft.
- Q = discharge, gallons per minute (gpm) or million gallons per day (mgd).

The nomogram normally will be used to solve velocity and discharge for a conduit of known dimensions when either the friction loss or slope of

the channel bottom, both expressed as drop in ft per 100 ft, is known. Solve in reverse if velocity or discharge is known and friction loss or channel slope is to be determined.

If the conduit is a pipe flowing partially full, computing the hydraulic radius is difficult. A suggested method for dealing with this type of problem is to compute the velocity and/or discharge for a full pipe and correct results for the actually filled section. The curve shown in Fig. 1 gives the multiplier for velocity and discharge. Divide the actual depth of liquid by the full pipe depth for "ratio of depth of flow" and enter chart as directed. For example, if the velocity = 2.4 fps and discharge = 4.9 million gallons per day flowing full, then flowing $\frac{3}{4}$ full the velocity will be $(2.4)(1.11) = 2.66$ fps and discharge will be $(4.9)(0.79) = 3.87$ million gallons per day.

Example:

If $S = 0.15$ percent, $D = 24$ inches ($r = 0.5$ ft) and $n = 0.015$, find the flow.

Solution: Align $S = 0.15$ with $r = 0.5$ ($D = 24$ inches), intersecting the reference line. Align this intersection with $n = 0.015$, and read $V = 2.4$ ft/sec. Align this intersection with $A = 3.14$ ($D = 24$ inches) and read $Q = 3400$ gallons per minute or $Q = 4.9$ million gallons per day.

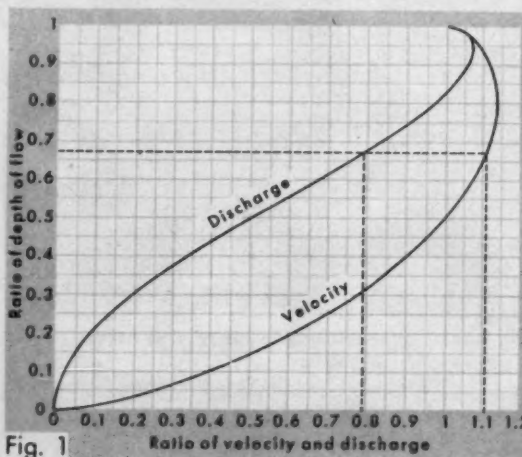


Fig. 1

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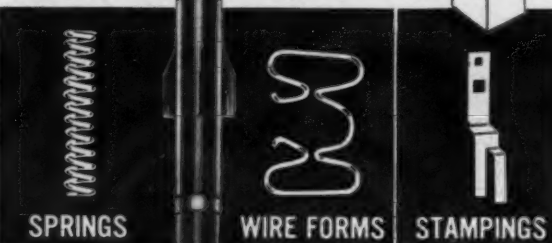
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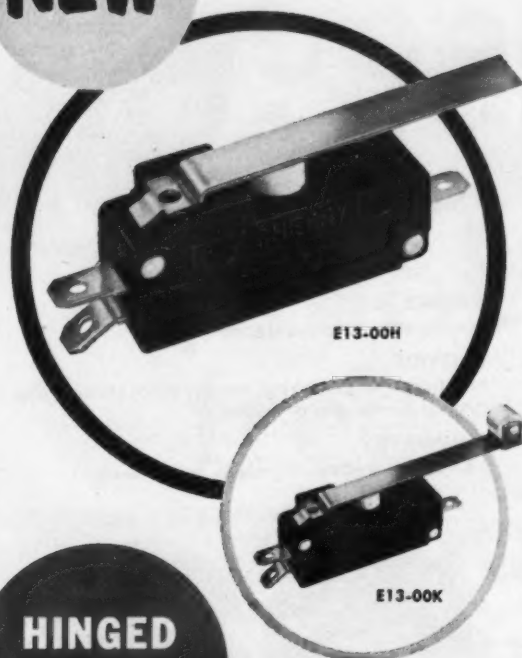
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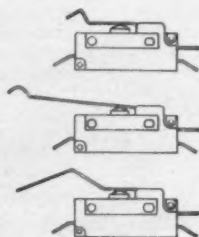
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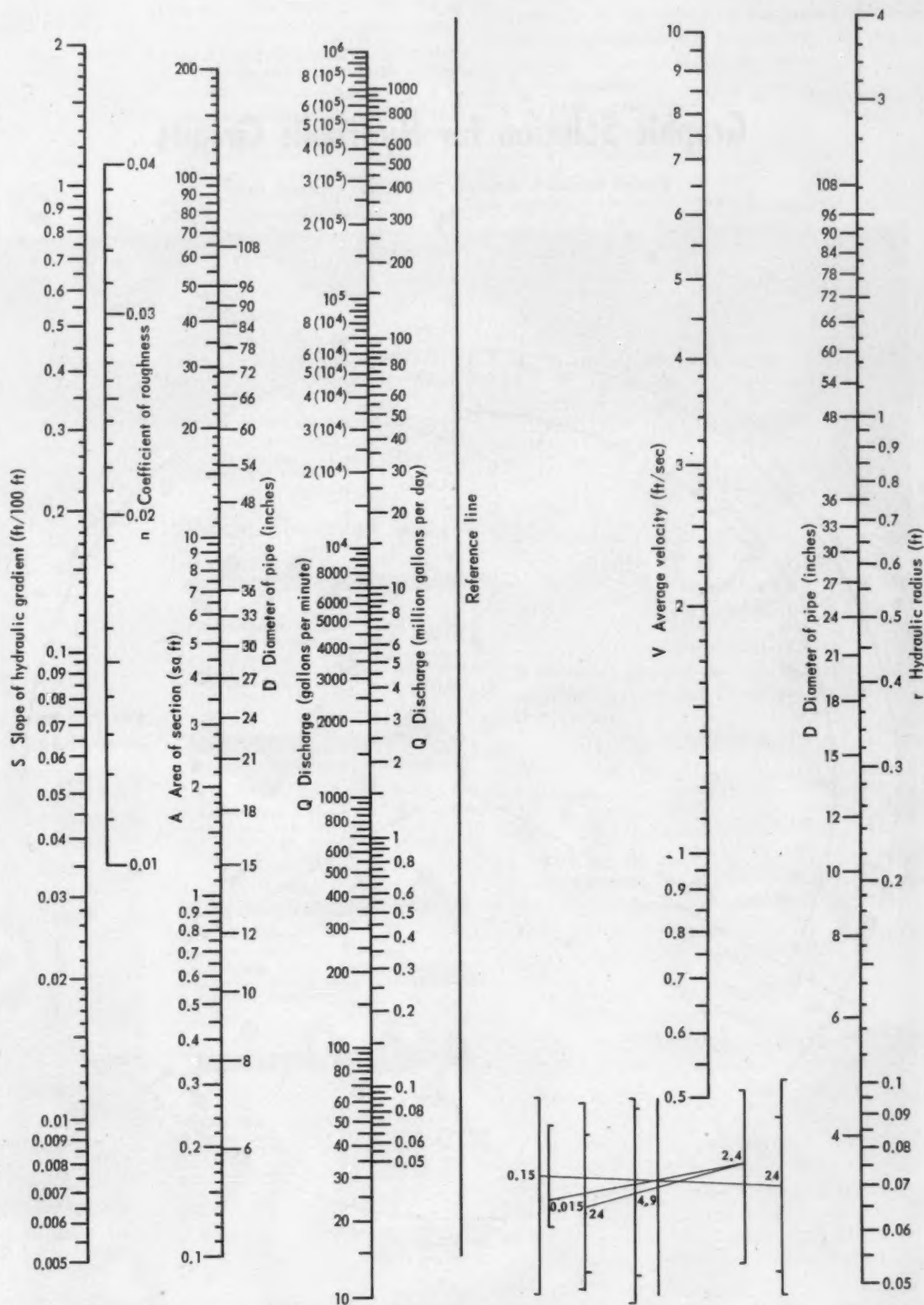
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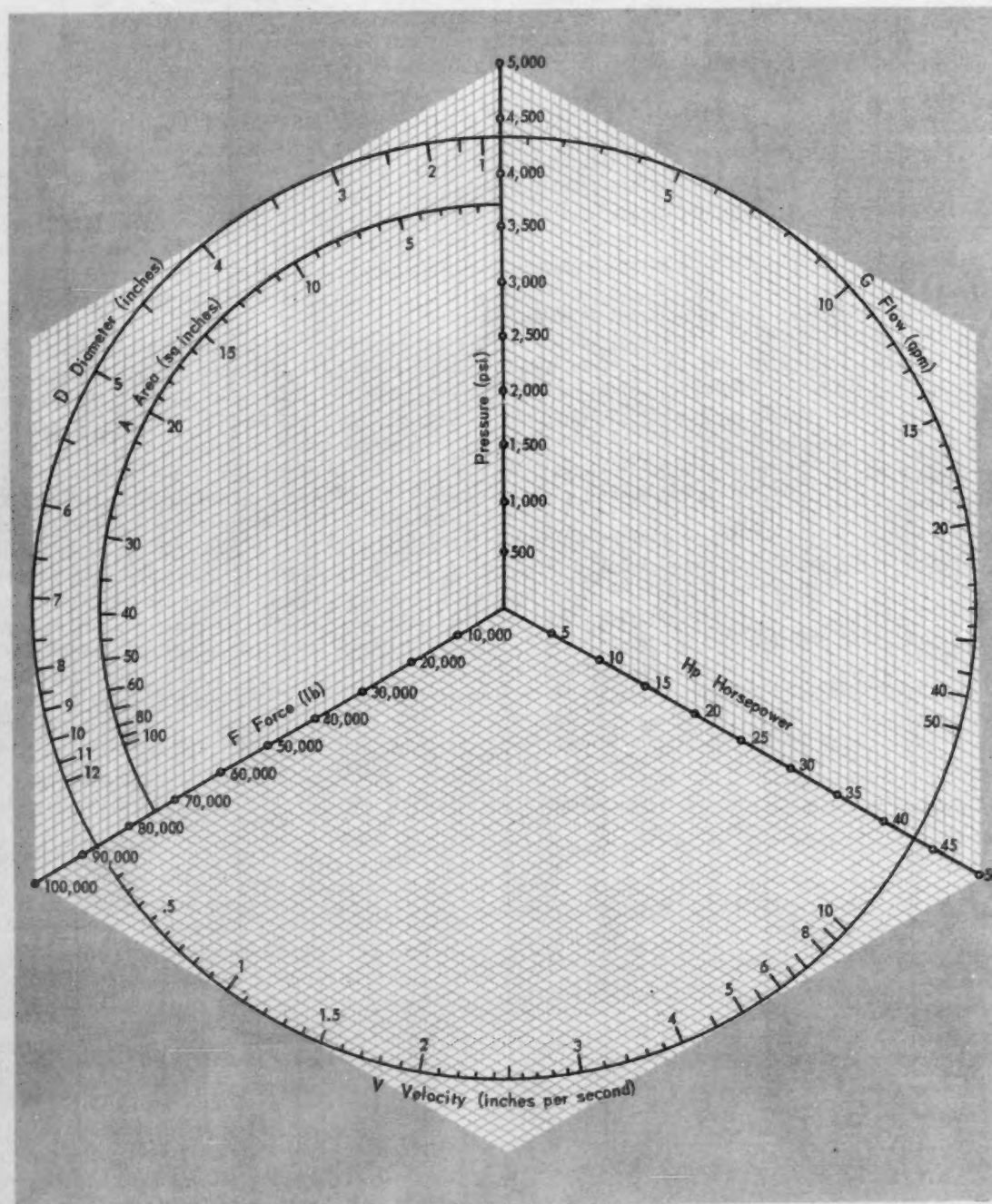
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Graphic Solution for Hydraulic Circuits

Richard Densmore, Densmore Engineering, Compton, Calif.



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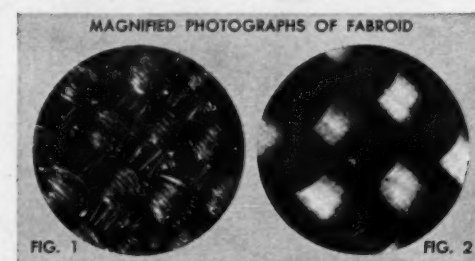
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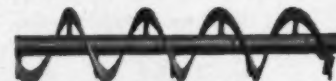
TYPICAL CONVEYOR SCREWS



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SCREW CONVEYORS

Because horsepower is a function of force, distance and time, an extremely useful set of equations can be developed for computing hydraulic circuits by approaching horsepower from two directions and equating the results.

Nomenclature:

- Hp = horsepower
- G = flow, gpm
- P = pressure, psi
- F = force, lb
- S = distance, inches
- t = time, seconds
- A = active area, sq in
- V = velocity, inches per second

To apply psi as a force in pounds, consider the geometry of a gallon as one inch square by 231 inches. P = F if acting on the one square inch, so 231 times G can be resolved into feet/second.

$$231 G = \text{inches/minute}$$

$$\text{and: } \frac{231 G}{(12)(60)} = \text{ft/sec}$$

$$\text{and: } \left[\frac{231 G}{(12)(60)} \right] (P) = \text{ft-lb/sec}$$

By definition:

$$\text{One } H_n = 550 \text{ ft-lb/sec}$$

$$\therefore H_p = \left[\frac{(231)}{(550)(12)(60)} \right] (G)(P) \\ = (0.000583)(G)(P)$$

Because a hydraulic circuit seldom should be calculated greater than 75 percent mechanical efficiency, use:

$$H_p = 0.00077 (G)(P) \quad (1)$$

Also

$$H_p = \frac{(F)(S/12)}{(550)(t)} = \frac{0.0001515(F)(S)}{t}$$

Or at 75 percent efficiency:

$$H_p = 0.0002(F)(S)/t \quad (2)$$

By equating (1) and (2) we have a true relationship because both equations have been reduced to 75 percent efficiency:

$$0.00077(G)(P) = 0.0002(F)(S)/t$$

But

$$F = (A)(P)$$

$$\therefore 0.00077(G) = 0.0002(A)(S)/t \quad (3)$$

This formula completely covers the volumetric function of hydraulic actuators or lines:

$$F = (A)(P) = \frac{3.85(G)(P)(t)}{S} \quad (4)$$

$$A = \frac{3.85(G)(t)}{S} \quad (5)$$

$$S = \frac{3.85(G)(t)}{A} \quad (6)$$

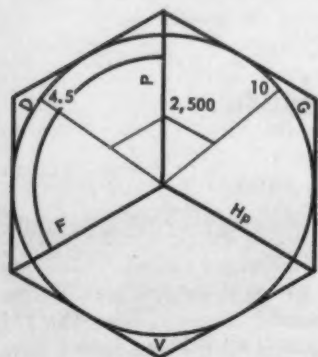
$$G = \frac{0.26(A)(S)}{t} \quad (7)$$

$$t = \frac{0.26(A)(S)}{G} \quad (8)$$

(Continued on next page)

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Hydraulic Circuits . . . Cont.



Example 1



Example 2

Since S/t = velocity in inches per second from Equation (6)

$$V = \frac{3.85(G)}{A} \quad (9)$$

By solving Equations (4) through (8) by Equations (1) and (2) for the mechanical relationships, we are using the 75 percent efficiency rating, and:

$$F = \frac{5000(Hp)(t)}{S} \quad (4a)$$

$$A = \frac{5000(Hp)(t)}{(S)(P)} \quad (5a)$$

$$S = \frac{5000(Hp)(t)}{(A)(P)} \quad (6a)$$

$$G = \frac{1300(Hp)}{P} \quad (7a)$$

$$t = \frac{0.0002(F)(S)}{Hp} \quad (8a)$$

Also from Equations (7a) and (4a):

$$P = \frac{1300(Hp)}{G} \quad (10)$$

$$V = \frac{5000(Hp)}{F} \quad (11)$$

A graph with isometric coordinates solves all of the functions of a hydraulic cylinder circuit. With any three of the six variables known, closing of "graphic loop" gives three remaining variables.

Because the graphic solution was developed from the preceding formulas, volumetric relations are actual and mechanical efficiency is 75 percent.

Examples:

(1) A flow of 10 gpm through a 4.5-inch dia pipe is required. If system pressure is established at 2500 psi, complete the "graphic loop" and read:

$$\begin{aligned} Hp &= 19.2, \\ V &= 2.42 \text{ inches/sec, and} \\ F &= 38,700 \text{ lb.} \end{aligned}$$

(2) A cylinder with a six-inch bore and a three-inch rod has a stroke of 60 inches. Design a system to pull 40,000 lb in 20 sec. Also, what is time of push and what is the force? Solve by completing two "loops" on the graph.

Cylinder Pulling:

$$\begin{aligned} V &= 60/20 = 3 \text{ inches/sec} \\ A &= \pi(6^2 - 3^2)/4 = 21.2 \text{ sq in} \\ G &= 16.5 \text{ gpm} \\ P &= 1880 \text{ psi, and} \\ Hp &= 24 \end{aligned}$$

Cylinder Pushing:

$$\begin{aligned} F &= 53,333 \text{ lb} \\ V &= 2.25 \text{ inches/sec, and} \\ t &= 60/2.25 = 26.6 \text{ sec} \end{aligned}$$

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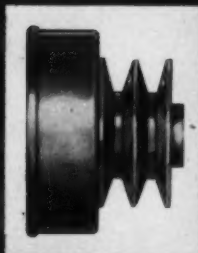
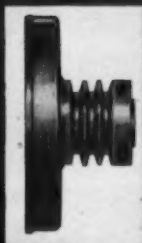
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MERCURY CLUTCH DIVISION
of Automatic Steel Products, Inc.
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Fundamental Formulas of Transcendental Functions

George D. Pheil, Racine, Wis.

THE LETTER U MAY REPRESENT THE INDEPENDENT VARIABLE OR A FUNCTION OF THE INDEPENDENT VARIABLE				
	BASIC TRIG FORMULA	DERIVATIVE IN TRIG FORM	INTEGRALS IN TRIG FORM	INTEGRALS IN LOGARITHMIC FORM
TRIG FORMS	$\sin u = \frac{\cos u}{\cot u}$ $\cos u = \frac{\sin u}{\tan u}$ $\tan u = \frac{\sin u}{\cos u}$ $\cot u = \frac{\cos u}{\sin u}$ $\sec u = \frac{1}{\cos u}$ $\csc u = \frac{1}{\sin u}$	$D_x \sin u = \cos u D_x u$ $D_x \cos u = -\sin u D_x u$ $D_x \tan u = \sec^2 u D_x u$ $D_x \cot u = -\csc^2 u D_x u$ $D_x \sec u = \sec u \tan u D_x u$ $D_x \csc u = -\csc u \cot u D_x u$	$\int \cos u du = \sin u + c$ $\int \sin u du = -\cos u + c$ $\int \sec^2 u du = \tan u + c$ $\int \csc^2 u du = -\cot u + c$ $\int \sec u \tan u du = \sec u + c$ $\int \csc u \cot u du = -\csc u + c$	$\int \tan u du = \ln \sec u + c = -\ln \cos u + c$ $\int \cot u du = \ln \csc u + c = -\ln \sin u + c$ $\int \sec u du = \ln \sec u + \tan u + c$ $\int \csc u du = \ln \csc u - \cot u + c$
HYPERBOLIC FORMS	$\sinh x = \frac{1}{2} (e^x - e^{-x})$ $\cosh x = \frac{1}{2} (e^x + e^{-x})$ $\tanh x = \frac{\sinh x}{\cosh x}$ $\coth x = \frac{1}{\tanh x} = \frac{\cosh x}{\sinh x}$ $\operatorname{sech} x = \frac{1}{\cosh x}$ $\operatorname{csch} x = \frac{1}{\sinh x}$	$D_x \sinh u = \cosh u D_x u$ $D_x \cosh u = \sinh u D_x u$ $D_x \tanh u = \operatorname{sech}^2 u D_x u$ $D_x \coth u = -\operatorname{csch}^2 u D_x u$ $D_x \operatorname{sech} u = -\operatorname{sech} u \tanh u D_x u$ $D_x \operatorname{csch} u = -\operatorname{csch} u \coth u D_x u$	$\int \cosh u du = \sinh u + c$ $\int \sinh u du = \cosh u + c$ $\int \operatorname{sech}^2 u du = \tanh u + c$ $\int \operatorname{csch}^2 u du = -\coth u + c$ $\int \operatorname{sech} u \tanh u du = -\operatorname{sech} u + c$ $\int \operatorname{csch} u \coth u du = -\operatorname{csch} u + c$	$\int \tanh u du = \ln \cosh u + c$ $\int \coth u du = \ln \sinh u + c$
INVERSE HYPERBOLIC FORMS	$\sinh^{-1} x = \ln (x + \sqrt{x^2 + 1})$, $\frac{du}{dx} = \frac{1}{\sqrt{x^2 + 1}}$ $\cosh^{-1} x = \ln (x + \sqrt{x^2 - 1})$, $\frac{du}{dx} = \frac{1}{\sqrt{x^2 - 1}}$, $x \geq 1$ $\tanh^{-1} x = \frac{1}{2} \ln \frac{1+x}{1-x}$, $-\frac{1}{2} < x < \frac{1}{2}$	$D_x \sinh^{-1} u = \frac{1}{\sqrt{u^2 + 1}} D_x u$ $D_x \cosh^{-1} u = \frac{1}{\sqrt{u^2 - 1}} D_x u$ $D_x \tanh^{-1} u = \frac{1}{1 - u^2} D_x u$ $D_x \coth^{-1} u = \frac{1}{u^2 - 1} D_x u$	$\int \frac{du}{\sqrt{u^2 + a^2}} = \sinh^{-1} \frac{u}{a} + c$ $\int \frac{du}{\sqrt{u^2 - a^2}} = \cosh^{-1} \frac{u}{a} + c$, $u > a > 0$ $\int \frac{du}{a^2 - u^2} = \frac{1}{a} \tanh^{-1} \frac{u}{a} + c$, $\frac{u^2}{a^2} < 1$ $\int \frac{du}{u^2 - a^2} = \frac{1}{2a} \coth^{-1} \frac{u}{a} + c$, $\frac{u^2}{a^2} > 1$	$\int \frac{du}{\sqrt{u^2 + a^2}} = \ln u + \sqrt{u^2 + a^2} + c$ $\int \frac{du}{\sqrt{u^2 - a^2}} = \ln u + \sqrt{u^2 - a^2} + c$, $\frac{u^2}{a^2} > 1$
INVERSE TRIG FORMS	$\theta = \arcsin x \rightarrow x = \sin \theta$ $\theta = \arccos x \rightarrow x = \cos \theta$ $\theta = \arctan x \rightarrow x = \tan \theta$ $\theta = \operatorname{arccot} x \rightarrow x = \cot \theta$ $\theta = \operatorname{arcsec} x \rightarrow x = \sec \theta$ $\theta = \operatorname{arccsc} x \rightarrow x = \csc \theta$	$D_x (\arcsin u) = \frac{1}{\sqrt{1 - u^2}} D_x u$ $D_x (\arccos u) = -\frac{1}{\sqrt{1 - u^2}} D_x u$ $D_x (\arctan u) = \frac{1}{1 + u^2} D_x u$ $D_x (\operatorname{arccot} u) = -\frac{1}{1 + u^2} D_x u$ $D_x (\operatorname{arcsec} u) = \frac{1}{\sqrt{u^2 - 1}} D_x u$ $D_x (\operatorname{arccsc} u) = -\frac{1}{\sqrt{u^2 - 1}} D_x u$	$\int \frac{du}{\sqrt{a^2 - u^2}} = \arcsin \frac{u}{a} + c$, $\frac{u^2}{a^2} < 1$ $\int \frac{du}{a^2 + u^2} = \frac{1}{a} \arctan \frac{u}{a} + c$	<p>*Integration forms not obtainable by direct reversal of standard differentiation formulas</p>
EXPONENTIAL FORMS	$y = a^u$ $y = e^u$ $y = e^x$	$D_x (a^u) = a^u \ln a D_x u$ $D_x (e^u) = e^u D_x u$ $D_x (e^x) = e^x$	$\int a^u du = \frac{a^u}{\ln a} + c$ $\int e^u du = e^u + c$ $\int e^x dx = e^x$	
LOGARITHMIC FORMS	$y = \log_a u$ $y = \ln u$ $y = \ln x$	$D_x (\log_a u) = \frac{1}{u} \log_a e D_x u$ $D_x (\ln u) = \frac{1}{u} D_x u$ $D_x (\ln x) = \frac{1}{x}$	$\int \frac{du}{u} = \ln u + c$, $\frac{u}{a} \neq 0$	

DESIGN DATA...

Plain Bearing Design Check

R. H. Warring, Beckenham, England

The diameter of a plain bearing is normally fixed by stiffness requirements which establish a suitable shaft size. The required length of bearing then follows from consideration of maximum permissible pressure on the bearing surface.

This nomogram gives solutions for required bearing length for a given maximum allowable bearing pressure. In addition, the nomogram serves to determine if calculated bearing length is consistent with best design practice for the rpm concerned. Left-hand scales are used first to determine the bearing length. This value is then connected to the extreme right-hand scale (shaft diameter) and optimum rpm value noted. This value should be in reasonable agreement with design rpm. If the optimum rpm differs from the design rpm by a considerable margin, the bearing may give poor results although apparently correctly stressed.

Example:

Given a permissible pressure on bearing material as 280 psi and actual load of 5000 lb. Shaft diameter = 2.25 inches and rpm = 90. Determine bearing length required.

Align $F = 5000$ with $P = 281$, intersecting reference line. Align $D = 2.25$ (left-hand scale) with reference line intersection and read bearing length required, $L = 2.52$ inches. Check speed rating of bearing.

Align $L = 2.52$ with $D = 2.25$ (right-hand scale) and read optimum rpm for bearing, rpm = 80. The design rpm is of the same order. The bearing size established, therefore, should be suitable. An increase in bearing length to 2.68 inches would, however, be beneficial.

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YOU CAN BE SURE OF UNIFORM PERFORMANCE FROM O-M CYLINDERS

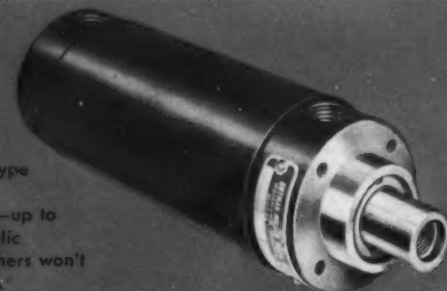
Whether you operate O-M Cylinders, of the same psi rating, bore and stroke, singly or in sequence, each one will exert the same force, handle the same work load, with the same precision. In addition, the direction of each stroke, length of each stroke as well as the time interval between cycles will be controlled to the same high degree of accuracy. As all parts and mounts of O-M Cylinders, of the same capacity, are micro-honed or accurately machined to the same close tolerances, they are interchangeable and precise. Uniform operation is automatic.

O-M Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Complete line of interchangeable parts and mounts. Immediate delivery on most sizes.

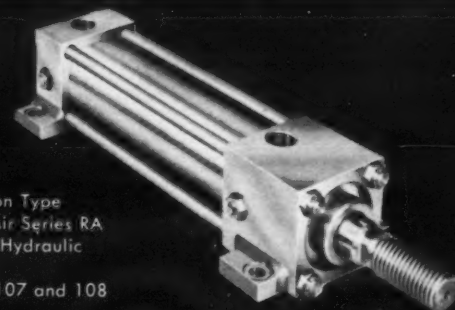
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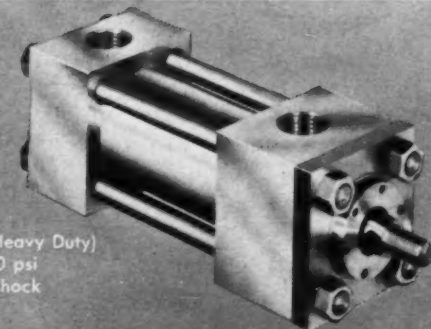
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Tie-Rodless Type
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DESIGN NEWS—FEBRUARY 13, 1961

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mentary Contact
Air flow . . . 80.04
cfm at 100 psi in-
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v. Pressure range
... 30 to 125 psi
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high; 4-1/4" wide;
2-3/4" thick.
(Model 250-4E1
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valve, same dimen-
sions).

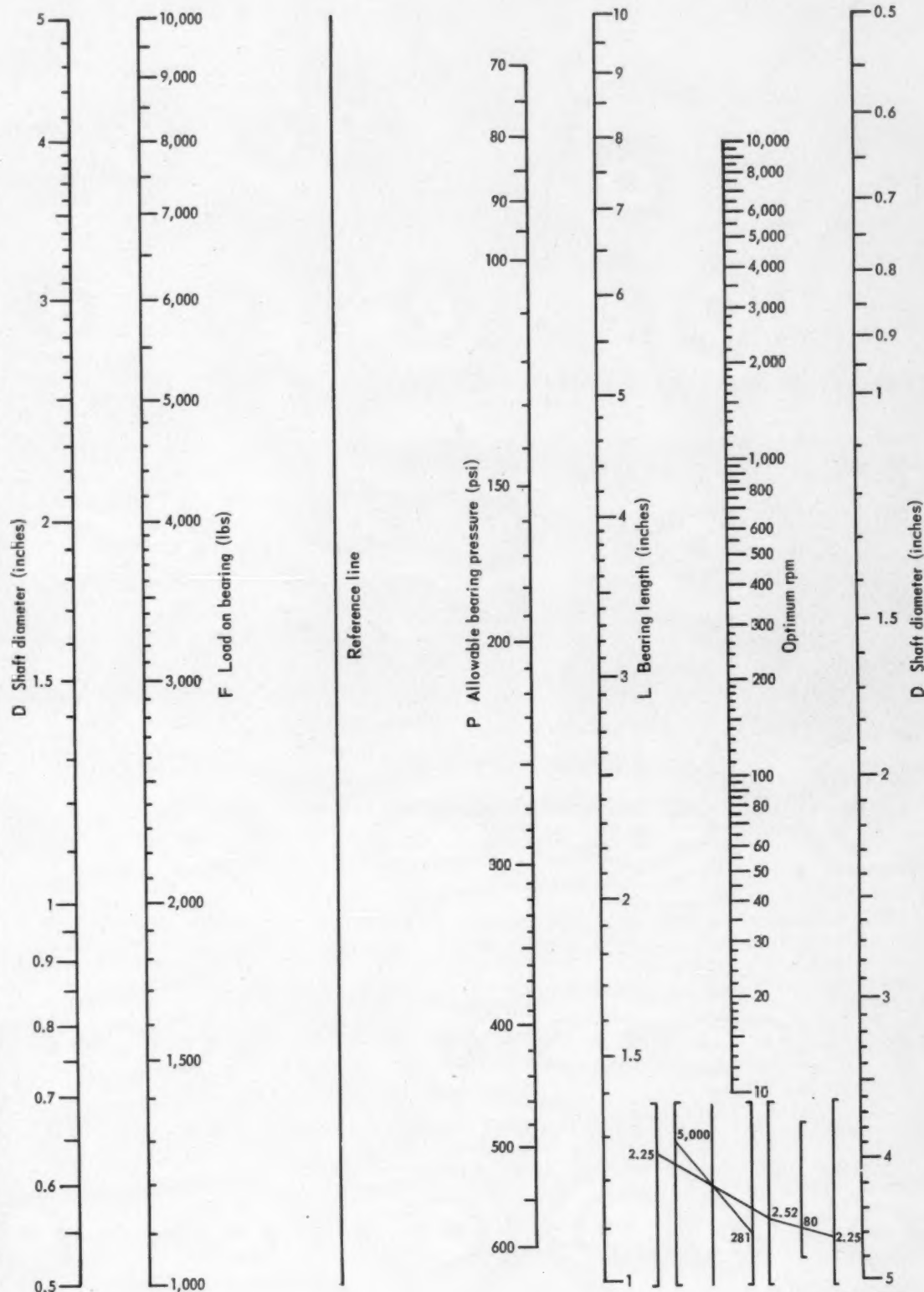
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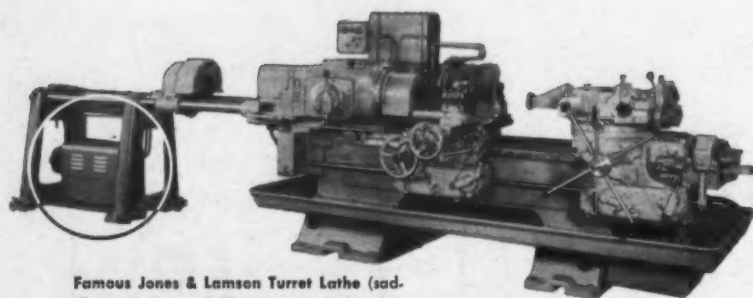
General Gas Light Company Box 2008, Kalamazoo, Mich.



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DESIGN NEWS—FEBRUARY 13, 1961

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Famous Jones & Lamson Turret Lathe (saddle type). Brown & Sharpe pump in housing under bar feed mechanism (left) helps move stock fast, with minimum operator effort.

How Jones & Lamson designers held costs down with Brown & Sharpe pumps



Standard B&S #1-S Pump, with special flange mounting, is built into each J&L unit. It has quiet helical gears, and needle type antifriction bearings.

Problem: Designers of this lathe needed a dependable pump in the hydraulic unit of the bar feed mechanism. This unit gives "fingertip" control in advancing and chucking stock to be machined. The pump must provide oil pressures to 500 psi, at a capacity of 3 3/4 gpm; and be flange-mounted and direct coupled to an 1800-rpm motor. Preferably, it should be a "stock" pump, for minimum cost.

Solution: A model 1-S pump with antifriction bearings, from Brown &

Sharpe's extra-complete line, meets requirements exactly, with only a minor change made for the customer's flange mounting. Since it is essentially a "stock" item, this pump is very reasonable in cost.

Idea: For the best solution to any pump problem — write Hydraulics Division, Brown & Sharpe Mfg. Co., Providence 1, R. I. Or contact your nearest B&S engineer representative. Brown & Sharpe makes gear, vane and centrifugal pumps to handle more fluids than any other manufacturer.

Brown & Sharpe
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NEW LITERATURE

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Template Kits

451

For tool designers, engineers and draftsmen. This is a complete kit of full-size tracing templates for jig and fixture components. Printed on one side only on individual 8 1/2 by 11-inch sheets of translucent paper, the templates can be used as overlays for correct location of components on drawings and to check fit. They can be slipped under drawings for tracing as either right-hand or left-hand components. The translucent paper also makes it possible to blueprint as many copies of the templates as needed. Included in the templates are a number of sizes of cams, knobs, handles, clamps, assemblies, "C"-washers, fixture jacks, index plungers, strap pads, flange nut assemblies and shoe clamp assemblies. Templates are sent in a filing envelope with index. Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, Ohio.

Silicone Rubber Selector Chart

452

One of the most complete silicone rubber specification guides available today. This 4-color publication is designed to assist engineers in all industries in selecting the proper type of silicone rubber for their particular requirements. The publication contains comprehensive data on applications, typical properties, primary classes, and standard industry and military specifications. To make selection of the proper silicone elastomer easy, compounds are divided into 4 general classes and typical uses of each class are described. General Electric Co., Silicone Products Dept., Waterford, N. Y.

Pressure-Sensitive Wire Markers

453

Lists over 400 different miniature wire markers for permanent or temporary identification of small wires and electronic components. The bulletin also contains complete, up-to-date application information and specifications for all four sizes wire markers. Technical engineering data is set up for fast reference by electrical engineers and purchasing personnel. Free testing samples are available. W. H. Brady Co., Dept. 130, 727 W. Glendale Ave., Milwaukee 9, Wis.

Service Shop Tips

454

This publication describes and illustrates almost 30 service shop gadgets, ideas and shortcuts, all designed to save time for the serviceman. These range from various ways to handle and salvage transistors to a technique for accurate cutting of dual concentric control shafts. Shown also are EIA color codes for power, audio and IF transformers, and for speaker lead and plug connections. Chicago Standard Transformer Corp., 3501 W. Addison St., Chicago 18, Ill.

Electronic Components

455

This 356-page book contains complete listings of products sold by 185 manufacturers. Included are up-to-date product and price specifications on electronic components, equipment and accessories for sound, industrial, amateur and service applications. A special section contains data on one of the most complete selections of high-fidelity and stereo equipment available anywhere. The catalog is completely indexed by product and by manufacturer. In addition, there are three special new product indexes—one general, one for amateur equipment and one for stereo products. Radio Products Sales, Inc., 1501 S. Hill St., Los Angeles 15, Calif.



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You get MEASURABLE ADVANTAGES
with General Electric Control



NEW General Electric Industrial Miniature Oil-tight Push Buttons Give You . . .

COLORS UNLIMITED, OVER 40% SPACE SAVINGS

Now you can reduce the size of your control panels at least 40 percent. New General Electric miniature oil-tight push buttons require only about half the panel space of heavy-duty oil-tight units.

Improve machine appearance. Unlimited color combinations are available in operators and rings to complement your equipment—provide positive color identification from any angle. Color is permanent; won't wear off, chip or fade.

Industry's first full line allows you to design entire panels with miniature units. Choose combinations of: standard (with or without guard) and mushroom-head push buttons; wobble stick operator; maintained and spring-return selector switches; coin-operated, cylinder-lock and bat-lever

selector switches; resistor and transformer-type illuminated push buttons, indicating lights, and push-to-test lights. G-E miniature push buttons are available in complete units or as separate components, to allow you to make up any form you need with a minimum stock.

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**NEW
HAMPSHIRE** } **BALL BEARINGS, INC.**
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From the office of
ARTHUR N. DANIELS,
President

RE: Instrument Ball Bearings

Gentlemen:

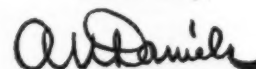
Most of us didn't learn much about anti-friction bearings in Engineering School. In my own case, we learned the difference between ball, roller and needle bearings, and that's about all. Literature on the subject is sparse; the variety of types, sizes and extra features is vast. All have their limitations, advantages and disadvantages.

This is a plea, then, for taking a Bearing Engineer into consultation before your layouts or designs are frozen. He is a professional and his services are free. We have ten of them, at your disposal, in addition to a staff of specialists at our home office.

True, they have an axe to grind: to sell you instrument ball bearings. But none of them wants to make recommendations that will fail to meet requirements, or to propose a marginal solution. Ethics of course prohibit their revealing your plans to others. Sometimes they will say "No," or "Maybe," or "Tests must be run." We've not accumulated all the answers yet, doubtless never will. Then, for confirmation, a competitor can be called in. We have a few who know a little about it. And, as sometimes happens among professionals, he may dissent, leaving the judgment up to you.

We believe too that our own new 150-page Design Manual is the most comprehensive treatise on instrument ball bearings published. We shall be glad to send you a registered copy by return mail.

Sincerely,



A. N. Daniels
President

Aerospace Fasteners

456

A 24-page selection guide to bolts for the aerospace industries. Roughly half the guide is devoted to an informative, heavily illustrated review of the company's reliability practices. Covered are material selection, fabrication and quality control of these critical high-strength and high-temperature fasteners for aircraft, missile, spacecraft and military electronics applications. Separate sections discuss heading practice, heat treatment, grinding, thread rolling and plating. Each relates specific techniques to beneficial properties in the bolting. The remainder of the guide consists of a rapid identification review of some 120 different SPS aerospace bolts. Included are tension and shear bolts, engine bolting, titanium and specialty fasteners—AN, MS, NAS and SPS standards. Standard Pressed Steel Co., Jenkintown, Pa.

Alloy Steel 'Spec' Chart

457

Easily identifies alloy steel government specifications. Chart shows chemical analysis requirements for the more widely used military, Army-Navy Aeronautical and Federal alloy steel specifications. Also listed are specified forms (sheets, bars, tubing) and nearest corresponding SAE, AISI and AMS numbers. With it alloy steel users will save valuable time normally lost checking through individual "specs". Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, N. Y.

Mil Spec Resistors

458

Physical and electrical characteristics for a complete range of wire-wound and carbon-film resistors, manufactured to military specifications and to commercial requirements. Feature of the engineering manual is a master chart of military-type wire-wound resistors available with extended ranges, higher wattage ratings, tighter resistance tolerances and special temperature coefficients. Catalog information includes all parameters defined by the specifications MIL-R-93B and MIL-R-944A and complete technical information for precision power resistors (MIL-R-26C), epoxy-cased carbon-film resistors (MIL-R-10509C), printed-circuit resistors (MIL-R-93B) and other military and commercial units. Mepco, Inc., Morristown, N. J.

Timing Motors

459

A condensed illustrated catalog on timing motors and time and torque controls. The 8-page folder explains designing, developing and producing timing units and provides complete descriptions of various units and their applications. The folder demonstrates the variety of timing motors and controls available, including time controls and indicators, electric brakes and clutches, military timers and clock movements. Dimensions and special design characteristics of these compact electric timing units are included. Haydon Div. of General Time Corp., 245 E. Elm St., Torrington, Conn.

New Chassis-Trak Utility Slides Support 15 Times Their Own Weight

Three Models—
TILT, TILT-DETENT,
and NON-TILT

With the introduction of the C-230 Utility Slide, Chassis-Trak can now offer a complete line of electronic cabinet slides in a capacity range from 50 to 275 lbs. The new Utility Slide can be used in any standard rack and in any type of mobile or stationary installation where the chassis load does not exceed 100 lbs.

Chassis-Trak's famous "pencil thin" design is an outstanding advantage of the new C-230. A pair of these fully-extendable slides take up only .620" of usable chassis space—far less than any other slides of equal capacity.

Made of hard, cold-rolled steel, each slide is cadmium plated and then coated with Poxylube 75. This is a bonded film of molybdenum disulfide which provides permanent dry lubrication and protects the metal against solvents, acids and corrosion.

Chassis-Trak C-230 slides are available in seven lengths—12" to 24"—and in a choice of tilt, tilt-detent or non-tilt models. The detent model locks in three positions—90° up, horizontal, and 90° down—for convenience in servicing both tube and circuitry sections.

For complete details and specifications on the new C-230 Utility Slide, write for Engineering Data Sheet No. 1600.



CHASSIS-TRAK, INC. • 525 SOUTH WEBSTER AVE. • INDIANAPOLIS 19, INDIANA
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LITERATURE...

Standard Crane Hand Signals

460

A pressure-sensitive decal. The crane hand signal chart, size $7\frac{1}{4}$ by $9\frac{3}{4}$ inches, is designed for installation in crane cabs and other spots for ready reference. Ederer Engineering Co., 2931 First Ave. S., Seattle 4, Wash.

Relays

461

Gives specifications, illustrations, descriptions and prices of relays carried in stock for immediate shipment. Included are a-c and d-c voltage-actuated relays; d-c current-actuated relays; general-purpose relays; subminiature, miniature, small and medium-size telephone-type relays; plug-in relays; hermetically sealed, removable dust-covered and see-through plastic-enclosed relays; 10, 15 and 50-amp small-power relays. Magnecraft Electric Co., 3350P W. Grand Ave., Chicago 51, Ill.

Rectifier Selector Chart

462

Helps the designer select optimum components rather than more expensive models which are rated above specific circuit applications. Chart will indicate optimum device to be used, based on average amps per cell, recurrent peak reverse voltage (PRV) and temperature. General Electric Co., W. Genesee St., Auburn, N. Y.

Low-Temp Solder Alloy

463

Technical data bulletin Z-105 describes Alloy D-800, a high-strength, low-temperature solder alloy. All data is listed, such as specific gravity, specific weight, compressive strength, fatigue strength, tensile strengths and hardness at various temperatures. Accurate Specialties Co., Inc., 345 Lodi St., Hackensack, N. J.

Aircraft and Missile Fasteners

464

Precision fasteners for the aircraft, missile and electronics industries are discussed in a 16-page brochure. Covered are Torq-Set, Phillips, External and Internal Hex, 12-Point External Wrenching Bolts and all types of precision fastener. Air Industries of Calif., 1559 W. 134th St., Gardena, Calif.

Reproducing Federal Tax Returns

465

Names the states which authorize reproductions of tax returns. The booklet includes a reference table which indicates correct size, type and color of copy paper to be used for making copies of individual tax forms. Also included is a list of important rules and hints to follow when preparing dry copy tax returns for filing. Minnesota Mining & Mfg. Co., Dept. L1-24, 900 Bush Ave., St. Paul 6, Minn.

Thermostats

466

Features exposed or enclosed bimetal disc thermal elements. A partial listing of products includes: refrigerators, freezers, water heaters, wall and portable heaters, motors, air conditioning, heating and ventilating equipment, washers, vending machines, unit heaters and table appliances. The bulletin illustrates the major units, giving

technical details on optional features such as available terminals, terminal mountings and flange-mounted assemblies. Ranges, tolerances, differentials and ratings are also given. Stevens Mfg. Co., Inc., P. O. 1007, Mansfield, Ohio.

Common Rectifier Circuits Chart

467

Aids the designer in choosing the right device more economically and without time-consuming reference to specification sheets and other information sources. When the PRV and average amps per cell are not known, the data can be obtained from this chart to determine optimum rectifier needed. Color coding is used to simplify chart, and easy-to-understand explanatory notes appear on the chart. General Electrical Co., W. Genesee St., Auburn, N. Y.

Miniature and Instrument Bearings

468

A complete and up-to-date miniature and instrument bearing catalog. The 40 pages contain dimensional information as well as practical engineering and application data required to service this highly specialized field. It offers all data necessary for the selection and specification of ball bearings for modern instruments. Bearings are pictured in actual size. Fafnir Bearing Co., 37 Booth St., New Britain, Conn.

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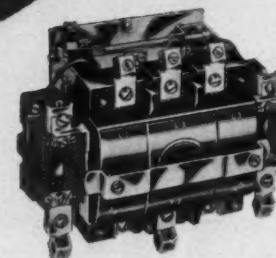
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Rotary Solenoids

470

A 2-page, illustrated sheet showing some basic application principles of rotary solenoids. Graphic sketches show the efficiency of the solenoids, capable of driving rotary switches, operating shutters or vanes and actuating remote counters. Ledex Inc., 123 Webster St., Dayton 2, Ohio.

Custom Alloy Steel Castings

471

Contains technical data regarding heat, corrosion and abrasion-resistant alloy steels. Charts listing nearly half of the more than 100

available cast alloys are included, as well as descriptions of services and casting methods. Catalog 175 DS will be of value especially to the process and manufacturing industries primarily interested in low and high alloy and stainless-steel castings. ESCO Corp., 2141 N. W. 25th Ave., Portland 10, Ore.

Polyethylene Data Guide

472

A 6-page brochure on a complete line of film-grade polyethylene resins. Brochure contains tabular data on significant properties of these resins. Both ASTM density types I and II are represented. Packaging and other suggested film applications are included. Rexall Chemical Co., Literature Service, P. O. Box 37, Paramus, N. J.

Precision Gears

473

A 128-page pocket-size catalog detailing a line of stock precision I, II and III gears and precision instrument clamps. Catalog is complete with diagrams, dimensions, prices and other statistics for rapid selections by engineers and purchasing groups. Perfect Gear & Instrument Corp., subsid. of Liberty Electronics Corp., 339 E. Isis, Inglewood, Calif.

Phototubes

474

"Phototubes in Industry", a new bulletin in the popular "Tech Tips" series, describes high-vacuum as well as gas phototubes, photomultiplier tubes, photocells and photo-resistive cells. Typical applications are shown for photo-resistive cells combined with transistors, effects of temperature, excessive illumination and other environmental conditions. The bulletin also covers test methods and gives various suggestions for servicing equipment using photosensitive devices. CBS Electronics, 100 Endicott St., Danvers, Mass.

Clutches

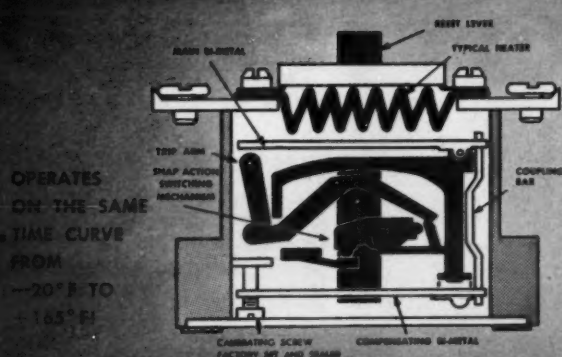
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Automatic centrifugal clutches and clutch couplings designed for a wide range of industrial power transmission applications are reviewed in this 42-page catalog. Designated No. 142, the catalog gives mechanical and design engineers a convenient quick-reference guide and fact file on these simplified, compact, all-metal clutches, their basic functions, principal advantages and performance characteristics. Also included are a number of tables, charts and graphs covering horsepower ratings, service factors, allowable acceleration and representative mounting arrangements. Form-sprag Co., 23601 Hoover Rd., Warren, Mich.

Potentiometer Specs 476

A 28-page technical catalog on a line of precision potentiometers. Detailed specifications, outline drawings and general information cover a range of miniature and full-size units from $\frac{1}{2}$ to 5 inches in diameter. Catalog is valuable for purchasing files, company libraries and technical personnel who buy or specify potentiometers. DeJur-Amsco Corp., Electronic Sales Div., 45-01 Northern Blvd., Long Island City 1, N. Y.

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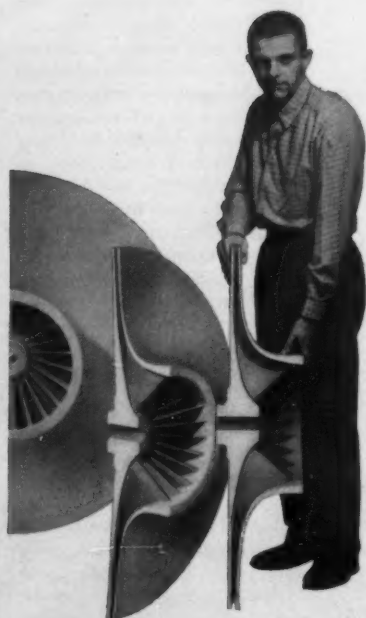
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FALLOUT FROM NUCLEAR WEAPONS TESTS. Hearings before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, 86th Cong., 1st sess., May 5-8, 1959:

Vol. 1. Covers a general review of developments since the 1957 hearings; a summary of new data on atmospheric fallout and global fallout. Published 1959; 948 pages; illustrated; Catalog No. Y4.At7/2:F19/3/v.1: \$2.75.

Vol. 2. Starting with a summary of new data on uptake in milk, food and human bone, this volume covers fallout mechanisms, uptake; development in radiation biology; discussion of permissible exposure levels, status and implications of testing; discussion of surveillance; and summary of problems and needs, including level of support. Published 1959; pages 949 through 1967; illustrated; Catalog No. Y4.At7/2:F19/3/v.2: \$2.75.

Vol. 3. An appendix to the hearings containing additional materials pertinent to discussions. Published 1959; pages 1969 through 2618; illustrated; Catalog No. Y4.At7/2:F19/3/v.3; \$1.75.

Vol. 4. A detailed, alphabetical index of the hearings. Published 1960; pages 2619 through 2693; Catalog No. Y4.At7/2:F19/3/v.4; \$0.25.

SOVIET EDUCATION PROGRAMS. The third major study by the Office of Education on education in the Soviet Union, this bulletin deals specifically with the foundations, science and polytechnic curriculums in the general school, and with teacher preparation. Published 1960; 281 pages; illustrated; Catalog No. FS5.214:14037; \$1.25.

IF YOU WORK WHILE YOU GET SOCIAL SECURITY PAYMENTS. Explains the provisions of the law which, in effect, measure a beneficiary's retirement or loss of earnings and which tell how much in benefits are payable to him for any particular month or year. Published 1960; 16 pages; Catalog No. FS3.35:23/7; \$0.05.

SURVEY OF INTERNATIONAL TRAVEL. Provides some basic facts and figures about the United States' share in the growing business of international travel. Published 1956; 63 pages; illustrated; Catalog No. C42.2:T69; \$0.35.

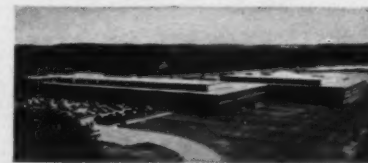
STATISTICS OF ELECTRIC UTILITIES IN THE UNITED STATES, 1959, PRIVATELY OWNED. Contains comprehensive financial and operating information on every important privately owned electric utility operating in the United States, including the new states, Alaska and Hawaii. The information was taken from the annual reports of class A and class B privately owned electric utilities to the Federal Power Commission for the year 1959. Published 1960; 414 pages; illustrated; Catalog No. FP1.21:145; \$2.50.

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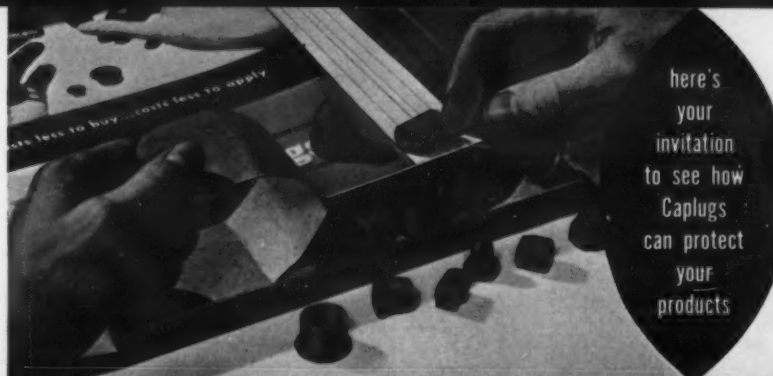
SCIENTIFIC AND TECHNICAL PERSONNEL IN AMERICAN INDUSTRY, REPORT ON A 1959 SURVEY. Presents the major findings of a survey of the employment of scientific and technical personnel in private industry as of January, 1959. Published 1960; 66 pages; illustrated; Catalog No. NS1.2:Sci2/9; \$0.45.

POLICY PLANNING FOR SPACE TELECOMMUNICATIONS. A staff report prepared for the Committee on Aeronautical and Space Sciences, to serve as an analysis of the current situation, both national and international, regarding the use and planned use of the radiofrequency spectrum, especially as related to space telecommunications. Published 1960; 207 pages; Catalog No. Y4.Ae8:T23; \$0.55.

ENERGY RESOURCES AND GOVERNMENT. Contains a collection of papers submitted to the Subcommittee on Automation and Energy. Resources by Federal and State regulatory and development agencies concerned with the production, distribution or development of energy resources. These papers were received in response to inquiries sent to these agencies for the purpose of uncovering and studying the variety and extent of the present complex of relationships between owners, producers, distributors and the several levels and instrumentalities of government. Published 1960; 603 pages; illustrated; Catalog No. Y4.Ec7:En2/2; \$2.00.



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TECHNICAL PAPERS

Programming For Process Control

Emil R. Borgers,
The Thompson-Ramo-Wooldridge Products Co.,
Beverly Hills, Calif.

Technological evolution of the digital computer has produced another type of machine—distinct from its scientific and business forerunner—the real-time control computer. It is the function of these computers to monitor and/or control complex operations and activities as they take place.

It is the purpose of this paper to discuss the programming of such a computer and show how it differs from other more familiar types of digital computer programming.

Real-Time Control Computer

Digital computers will vary in size, appearance, cost and speed as a function of their design objective. Taken as a whole, they can be thought to be composed of four units. A general block diagram is shown in Fig. 1 below:

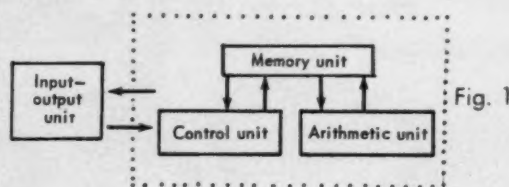


Fig. 1

The memory unit of the computer contains the instructions which actually will cause the computer to perform in a specified manner and the data constants which are necessary to solve given problems. The more common types of memory units are magnetic cores, drums, discs and tapes.

The arithmetic unit performs the necessary calculations (such as add, subtract, multiply) within the computer.

The input-output unit is the means by which information is inserted into, and received from, the computer. Magnetic-tape units, card readers and punches, printers or typewriters in some combination will comprise this unit.

The control unit is the "traffic cop" of the computer. It calls out instructions from the memory unit, gives the proper commands to the arithmetic unit and operates the input-output unit.

Computers may be built to solve intricate scientific or business problems. In general, the objectives and the resultant effect on the computer units can be stated as shown in Fig. 2.

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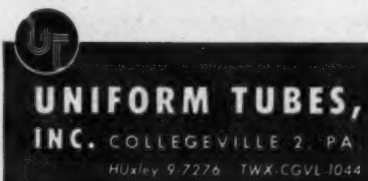
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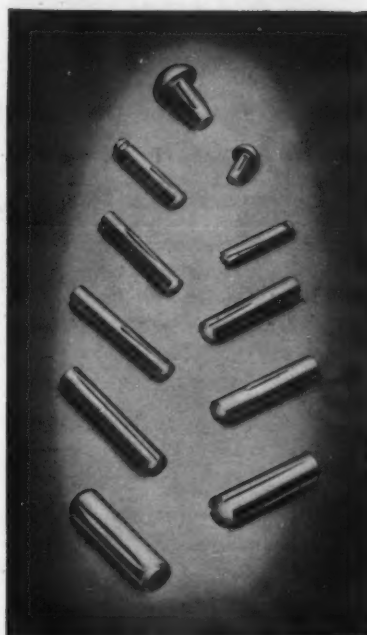
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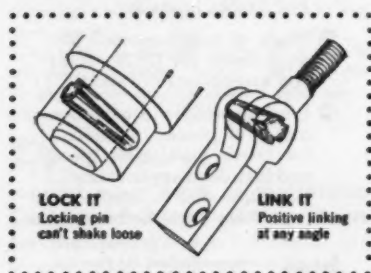
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DESIGN NEWS—FEBRUARY 13, 1961

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RESULTANT ARITHMETIC UNIT	Complex-fast	Complex-fast	Simple and reliable
RESULTANT CONTROL UNIT	Complex-fast	Complex-fast	Simple and reliable
RESULTANT INPUT-OUTPUT UNIT	Fast as possible	Many and varied components	Flexibility

Fig. 2

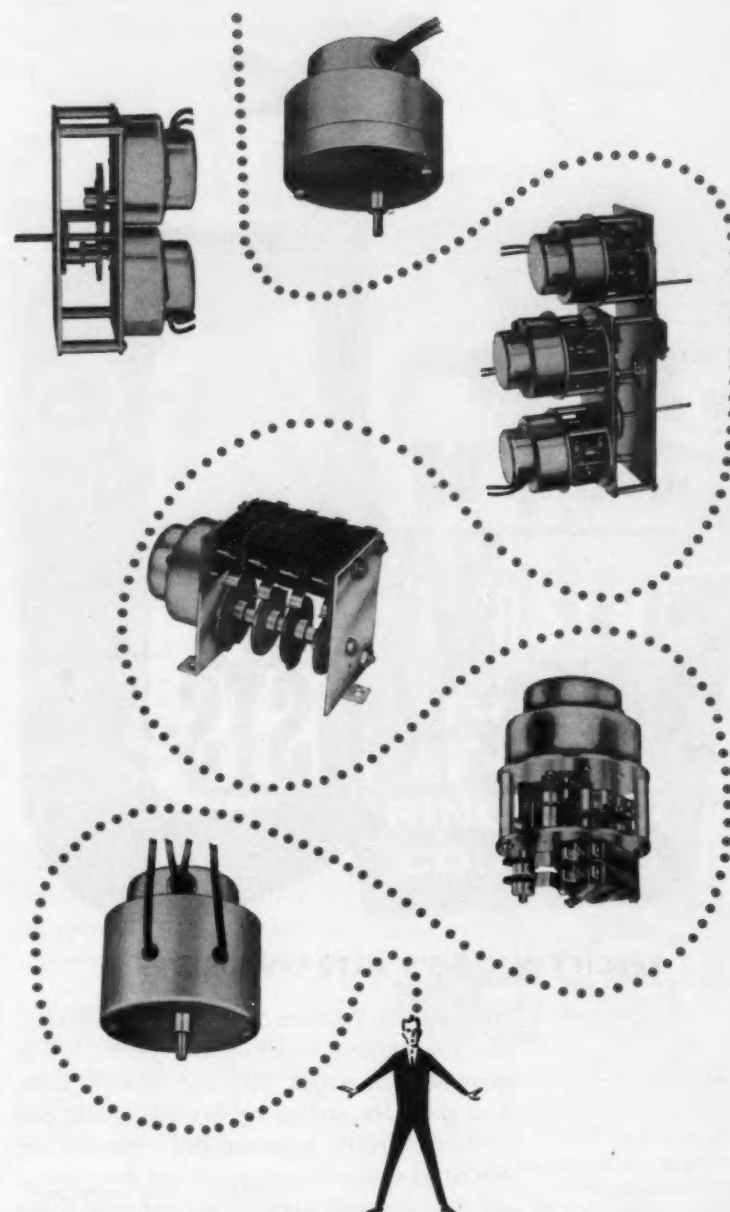
The Process Control Problem

In real-time process control, the "solution" is merely an input to another problem which, in turn, has a "solution". As an example, we may wish to perform the control function in Fig. 3.

In this example, each of the square boxes represents a detailed program whose function is to solve the described problem. Each of these programs may require many weeks to define, diagram, code and check. The "oval" areas describe decisions which must be made by the program.

The control system contained in this diagram represents a continuous operation of each of the programs contained in the rectangular boxes. As the last program is completed, the first is started again. Of course, it can be seen that the time required to complete the total control system will vary, depending on the circumstances. For instance, the oval area inscribed "Data OK?" has two paths. If the data is not within prescribed limits, the operator must be informed by having the computer type out the faulty piece of data, sound an audible alarm or some other appropriate action. If the data is all within limits, no extra actions need be performed. In either case, the next program to be operated is to "Solve Control Equations". It can be seen then that, in one case, some interval of time (say 30 seconds) will

(Continued on next page)



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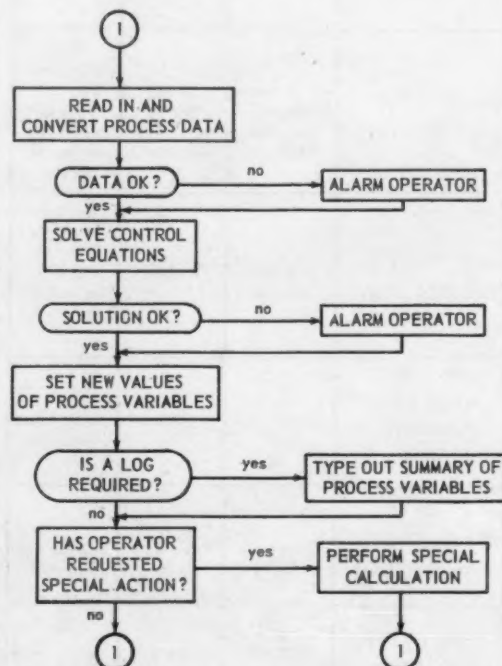
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Process Control . . . Cont.



elapse between the data conversion and control equation solution while in the other case, no time will elapse. If the computer control of a process were permitted as shown in the diagram, the total operating time would vary and the operator would not be able to say just how frequently the computer was reading in process data.

A more orderly and more workable method is tied directly to a clock available to the computer. An overall control is implied which only allows the solution of the control equations, say, every six minutes even though the computer is ready to perform them earlier. We then must superimpose on each of the program boxes as shown in Fig. 4.

A group of programs to perform the control of a process may require over 3000 instructions. When the control system is completed and the control computer inserted in the process loop, these programs will operate hour after hour, day after day, year after year, as long as the process exists. The number of executions of a particular process control system could easily exceed one-half million.

As the process-control programmer is designing his program, he must therefore be well aware of the "permanency" of his program. He is not just using the computer as a tool to arrive at a solution, like a slide rule or desk calculator; he is helping to create a tremendously powerful instrument of control.

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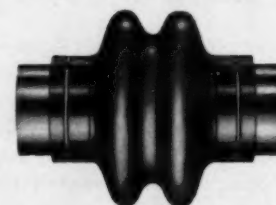
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Programming for Reliability

The control program also must be designed to detect failures of instrumentation and, if they occur, continue to operate with limited information. When lack of information increases to a danger point, the computer must inform the operator and, depending on the circumstances, take itself off-line.

The process control program also must be capable of checking components of the system external to the computer, as well as the computer itself. It should have available a test analog input and output with which to check the functioning of the analog conversion system. Finally, the program should exercise all of the internal functions of the computer to determine whether it is performing in an acceptable manner.

To the scientific and business programmer, the problem of time versus space does not present too difficult a problem. Usually, overall rules can be applied which will satisfy a whole group of programmers and these rules need seldom be violated. But what of the process control programmer? He is helping to create a tremendous instrument of control which will function for a long period of time. The process control programmer has, therefore, the sometimes conflicting requirements of: (a) effective use of computer memory and (b) rapid operation of the entire program. To meet these objectives, the programmer must continue to re-evaluate his objective as he lays out each part of the control system. The programmer first must be thoroughly familiar with the timing specifications of the entire program. How often must the program scan input variables? How often must the control calculations be performed? Are there any key emergency indicators which must be investigated frequently? What combination of circumstances can prolong the scanning and calculation functions? Knowing these important timing criteria, the programmer can take the following approach—program all routine to require only one-half the allowed operation time. Program the most critical routines first. If, as work progresses,

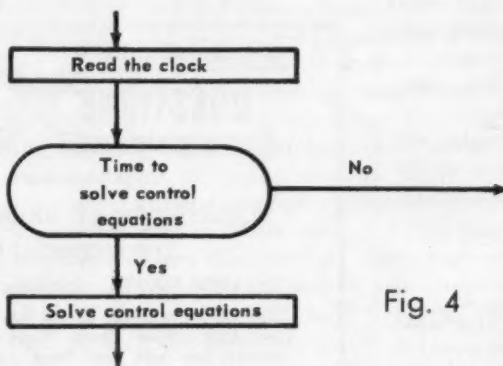


Fig. 4

(Continued on next page)

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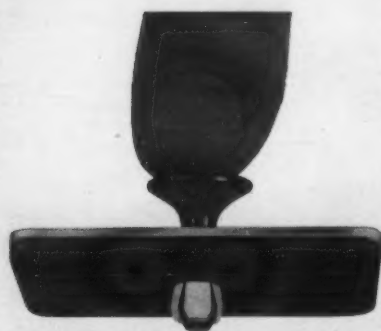
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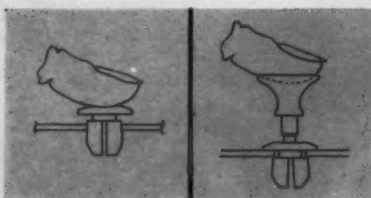
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Process Control . . . Conf.

space becomes an important factor, sacrifice the "time-buffer" to gain the space. Even with this approach, it may be necessary to reprogram some routines to meet the objectives. As more experience is gained, the reprogramming requirement will be reduced to zero.

Techniques of Programming to Provide for Modifications and Improvements

Typically, digital control computers are installed in new processes or in existing processes which have recently undergone improved instrumentation. The process control programmer, then, must be well aware of the ease-of-modification requirement while he is designing the control scheme, no matter how perfectly he feels the control system will perform. To provide a program which is easy to supplement or modify, the programmer must consider the following principles:

1. Design the program to follow particular paths of operation based on a sequential list of control words. The objective in this method of program design is to gain as many alternatives in program operation as possible by merely changing a few words in memory. Logged variables, scanned variables, alpha-numeric designations should also be made into logical, sequential lists for ease of modifications.

2. All independent functions should be programmed as separate subroutines under control of a master, executive routine. Some changes in operation then can be made by modification of the executive routine. If changes must be made within a subroutine, they can be made without affecting others.

3. Avoid multiple use of constants by different parts of the program. This will only lead to misery later when the constant must be changed for use by one subroutine and not for others.

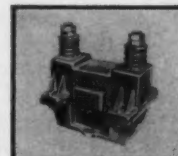
4. Avoid excessive "trickiness" in programming. A typical process control program will pass through many hands during the computer control system installation and future operation.

5. Do a thorough job of documenting the completed program, including all flow diagrams, annotated listings, storage maps and routine descriptions. For a typical process control program, this may include about 200 pages of detailed information.

Abstracted from a technical paper, "Programming for Process Control"; No. CP 60-975; \$100; to AIEE members, \$50. American Institute of Electrical Engineers, 33 West 39th St., New York 18, N. Y.



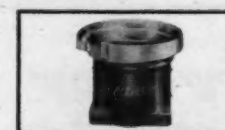
Materials Handling Equipment



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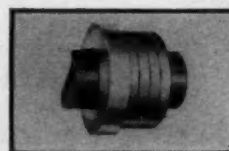


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PARTS FEEDERS

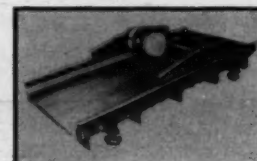
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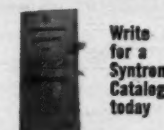
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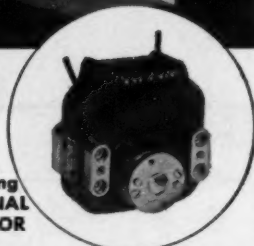
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Circle 179 on Reader-Service Card

Correct Design Minimizes Corrosion of Trucks

C. O. Durbin, Chrysler Corp., Detroit, Mich.

Corrosion prevention of trucks, as well as passenger cars, has received increased attention from design and materials engineers for several years. The increased usage of de-icing salts on highways greatly accelerates corrosion of unprotected steel and causes corrosion of exposed electrical components. Usually the best and least costly method of corrosion prevention is to study the probability of corrosion in the design stages and to avoid use of configurations which will tend to promote corrosion.

Corrosion Prevention Of Electrical Components

The most serious corrosion of trucks encountered during the last several years has been that of electrical components and wiring. The electrical wires for tail and directional signal lamps and connection blocks were mounted on the top side of the frame rail lower flanges, Fig. 1. When connections are made in this way, they become covered with dirt and de-icing salts from wheel splash. Moisture and salt then leak into the connectors and conduct current to the frame when the wires are energized. With a negative ground battery, this stray electrical current causes severe corrosion of the terminals. With a positive-grounded battery, the connectors are not affected materially, but frame corrosion occurs. Since the exposed frame area is large in comparison to that of the wire connectors, damaging corrosion is not as rapid.

Three methods of reducing this type of corrosion are apparent: (1) seal the connectors to prevent entrance of moisture, (2) coat the frame with insulating paints and (3) locate the connector in an area not subjected to wheel splash. The easiest method to avoid this type of frame and terminal corrosion is to change the location. It has been found that running the wire along the bottom side of frame rail top flange or on the side of the rail, Fig. 1, is a satisfactory method.

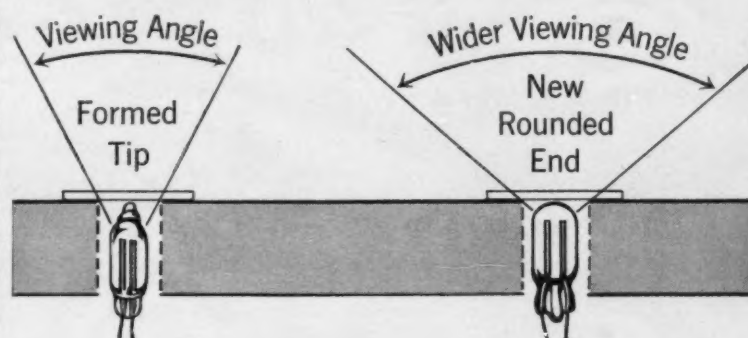
Locations for tail lamps, parking lamps and directional signal are fixed by considerations other than corrosion environment, and it is often necessary to place them in the direct path of wheel splash. Sealing all possible points where wheel splash can enter is desirable. Locations for sealing typical tail lamps are shown in Fig. 2.

Dimmer and stop lamp switches should be

(Continued on next page)



New round end General Electric glow lamps for better viewing ... and better looking indicators!



New shape of the Round End Glow Lamp brings its electrodes nearer to the end of the bulb—giving it a much wider viewing angle when flush mounted (see illustration above). And if the Round End Glow Lamp is placed beneath translucent material, the lighted area has a more uniform appearance.

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New General Electric NE-2M (for standard brightness) and NE-2P (for high brightness) Glow Lamps are more thoroughly described in the engineering data sheet, #3-9289. For your free copy, write: General Electric Company, Miniature Lamp Department M-112, Nela Park, Cleveland 12, Ohio.

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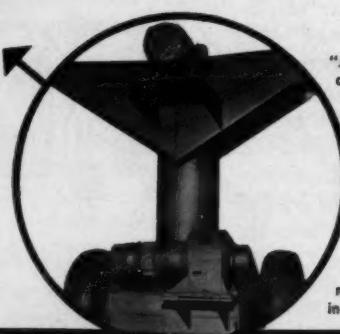
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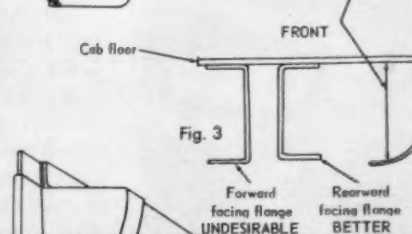
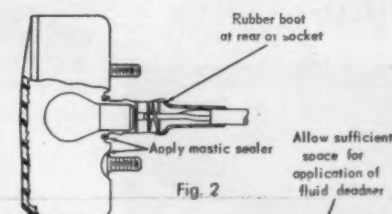
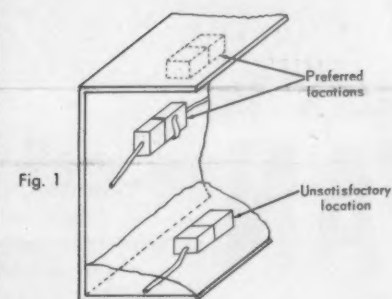
Two DIAMOND double-strand roller chains transmit power to wheels (one shown below with tire removed) and one transmits power to the raising and lowering mechanism. Wheels are propelled independently for steering purposes.



DIAMOND  **ROLLER CHAINS**

Circle 181 on Reader-Service Card for more information

Corrosion . . . Cont.



located inside the body of the vehicle. When this is impractical, the surfaces of the switch, particularly those surfaces containing terminals and exposed to wheel splash, should be protected with rubber or plastic boots.

Body Corrosion Prevention

Methods for prevention of corrosion of truck bodies or cabs by utilization of design concepts are similar to those of passenger cars. The use of ledges and horizontal flanges below the floor level of truck bodies, Fig. 3, which can trap and hold wheel splash, should be avoided. Where flanges are required for strength and rigidity, they should be narrow and, if possible, should face away from the nearest wheel.

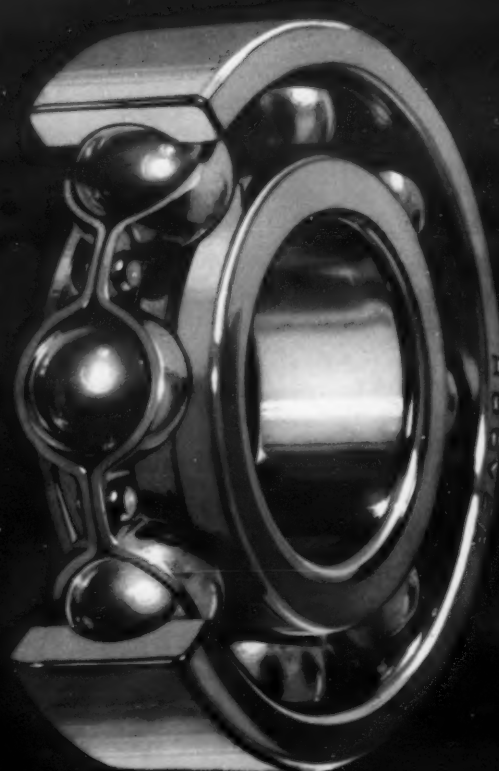
Door sills or rocker panels should be



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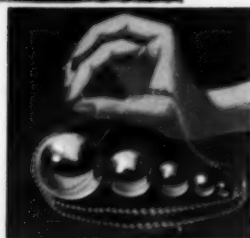
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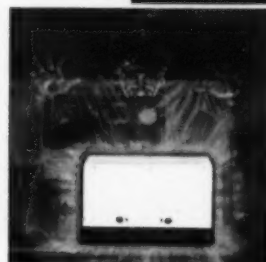


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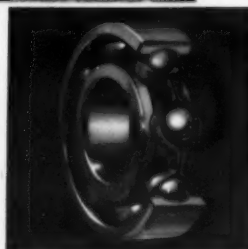
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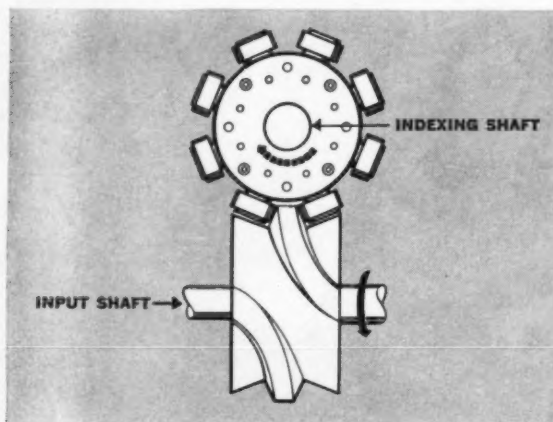
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How Ferguson *ELIMINATES BACKLASH* in Index Tables

Backlash in indexing results in shock loads that affect the efficiency of a machine and the quality of its product. Most indexing mechanisms have inherent characteristics that cause backlash and poor dynamic conditions and prevent the designer from taking full advantage of modern feeds, tooling and methods that contribute to production economy.



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FOLLOWERS

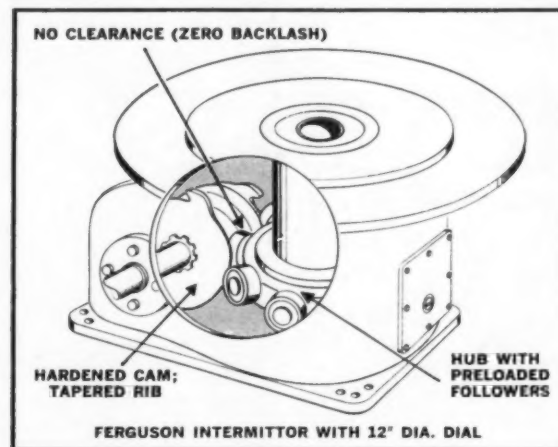


CAM RIB

NOTE HOW PRELOADED FOLLOWERS ENGAGE RIB

with zero backlash and an indexing accuracy of .001". Wear on the hardened tool steel cam is infinitesimal (many have been in use for more than 25 years). Followers are rated for a minimum of 8,000 hours opera-

tion. If backlash occurs after this period the life of the drive may be renewed merely by replacing the standard followers.



Compare this with other types of indexing devices. A geneva drive, with its slotted wheel and driver, and a barrel cam with a grooved track which engages one follower at a time, must have clearance in the slot or groove to allow passage of the follower. The slightest amount of clearance causes backlash. As the slot or groove wears, the clearance becomes greater and the backlash condition worsens. At the higher, more profitable operating speeds poor dynamics cause wear on other parts of the machine. The user must choose between frequent downtime for repairs or slower speeds . . . He is the loser in either case.

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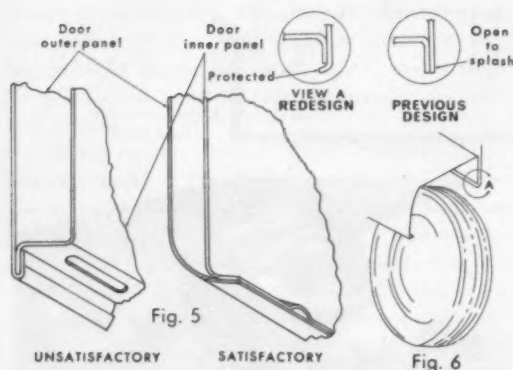
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designed to prevent or reduce entrance of wheel splash. Sealing of front and rear caps or lapping of flanges away from the wheel splash direction, Fig. 4, is recommended. Use of drain flutes in downstanding flanges, also shown in Fig. 4, is desirable.

Drain openings also are required to prevent corrosion on the inside of outer door panels. Fig. 5 shows satisfactory design of drain openings for doors.

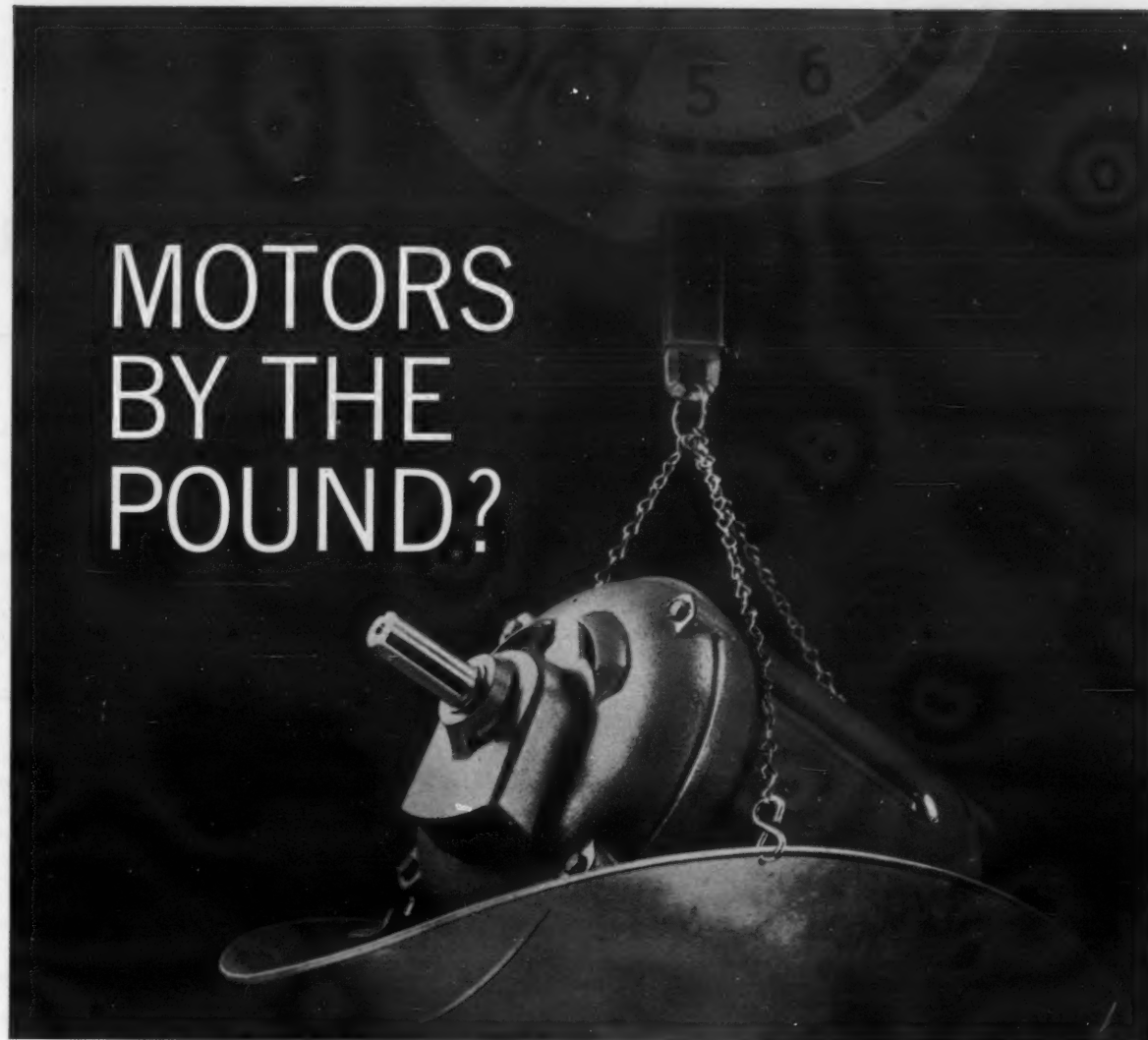
Lap joints in line with wheel splash should be flanged, Fig. 6, to prevent water and road salt and dirt from being driven between faying surfaces.

Providing adequate drainage and preventing direct entrance of wheel splash are insufficient to prevent corrosion in the body areas noted. The use of protective primers also is required for the internal surfaces of doors, sills and sliding door cavities. Provision should be made during design stages to permit coating of the internal surfaces with exterior body primer.



Abstracted from a technical paper, "Minimizing Corrosion on Trucks Through Design", SAE No. 248A; \$75; to SAE members, \$50. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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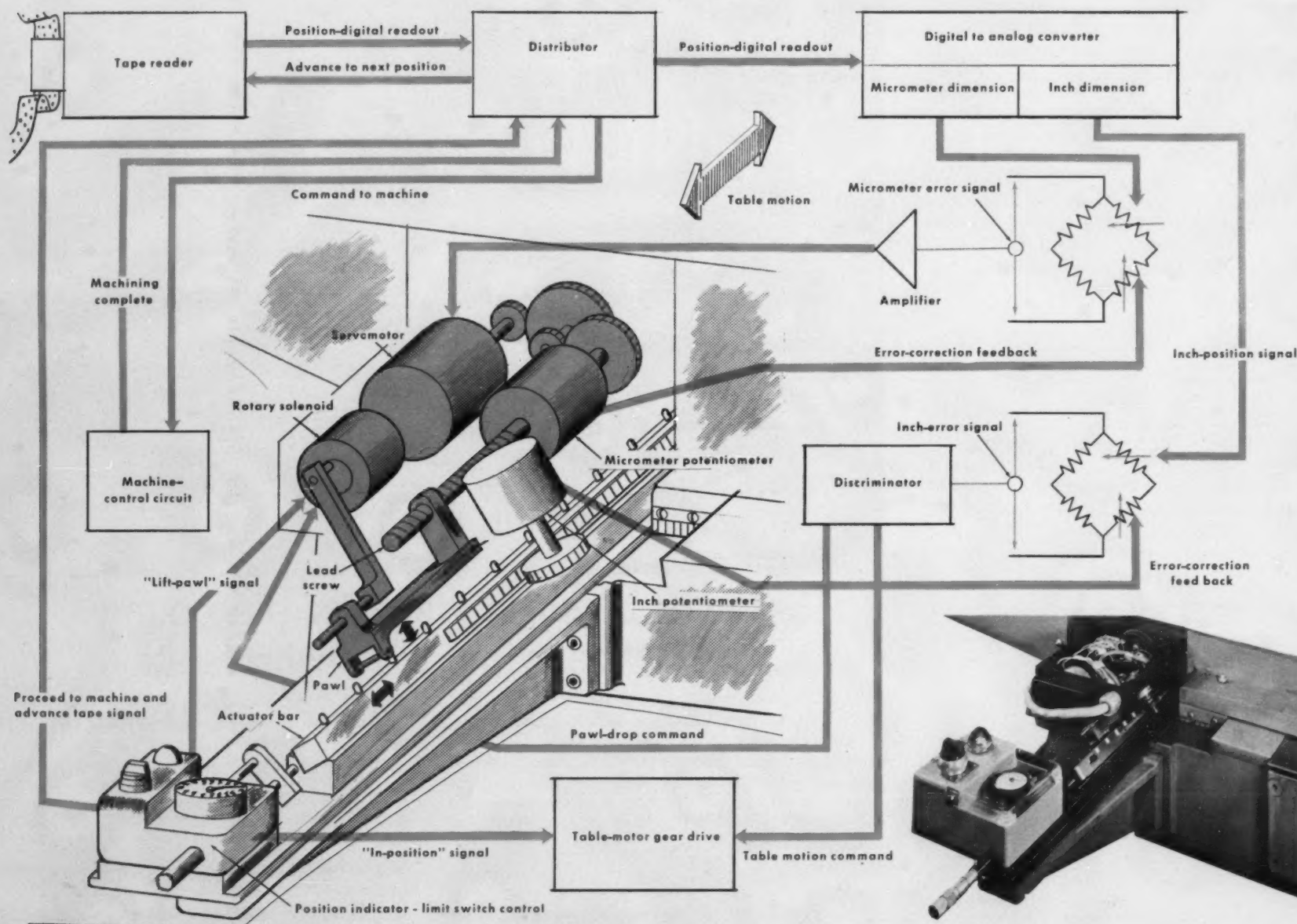
6487 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

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WM61-3

Servo-Adjusted Pawl Assures Precise Table Position

Victor W. Wigotsky, Eastern Editor

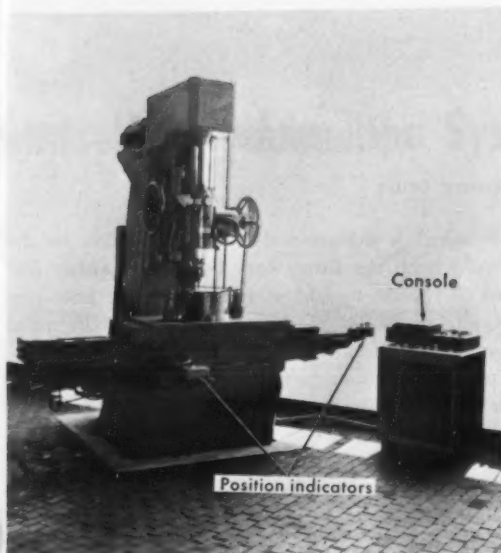


DIGITAL READOUT OF TAPE is fed through distributor and converted by relay matrix (in digital-to-analog converter) to analog signals. Position signals are inserted in respective null-sensing circuits. Micrometer error signal is fed to servo amplifier and then to servomicrometer. Servomotor

operates potentiometer and micrometer lead screw until error signal is nulled. Inch error signal is fed to discriminator. Upon command, discriminator relays power to table motor gear drive. Pawl engages inch bar when inch error signal is nulled by inch potentiometer, pinion and rack arrange-

ment. Final position is reached when inch bar actuator contacts limit switch. "In-position" signal is then transmitted to machine control circuit, micrometer pawl and tape reader. During machining cycle, digital readout of tape for next position takes place.

For Free Reprints of the Above Article, Circle 534 on Reader-Service Card



MODULAR CONTROL SYSTEM is shown installed on jig borer. Actuator bar in measurement section has eccentric pins which simplify manufacturing and permit precise dimensional adjustments. Mechanical variations in slide system can be corrected at proper pin position.

A servomicrometer positions an adjustable pawl in a numerical control system. Adjusted pawl position then represents the decimal portion of work table motion. System holds accuracy to 0.001 inch over 40-inch table motion.

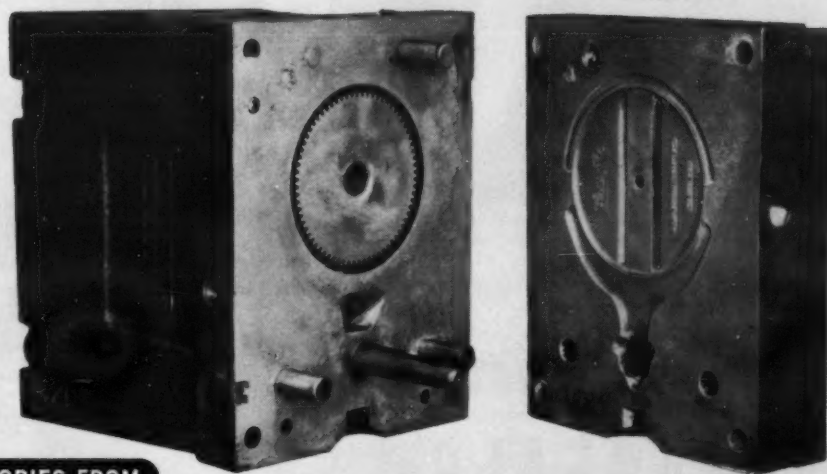
The overall control system is modular and includes input, control, measuring and table motor drive sections. The compact servomicrometer assembly functions with an actuator bar, having pins spaced one inch apart, and a position indicator control, to comprise the measuring section.

Nulling of the control system consists of two requirements. A "fine" position is provided by the servomicrometer assembly, which is fixed to the table. Adjustment of the pawl's position by its servomotor sets up the fine positioning requirement by linearly varying the electrical null signal to the micrometer control circuit. "Coarse" position circuit then locates the table to the nearest inch position.

When coarse position is achieved by the table motor drive, a rotary solenoid in the micrometer assembly causes the pawl to fall between the inch pins on the actuator bar. Table motion then continues until the bar contacts the position indicator to complete the cycle and initiate readout of the next position by the input section.

The low-cost numerical control system with modular design was developed by Diehl Mfg. Co., Subsidiary of the Singer Mfg. Co., Somerville, N. J.

48 years ago
Mt. Vernon
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CASE HISTORIES FROM MT. VERNON FILES

...and here's why the original die is still performing

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IDEAS... CONTROL SYSTEMS

Edward W. Schrader, Western Editor

Planetary Differential

A planetary differential drive introduces the necessary speed correction during reproduction to adjust for any speed variation which might otherwise occur between recording and reproducing operations on a magnetic tape system.

A synchronous drive motor provides the main power source. It is one input of a flat-belt speed reduction planetary differential system to the capstan moving the magnetic tape. A servo control motor, including a geared speed reducer, introduces speed corrections through the second input of the planetary differential to the capstan.

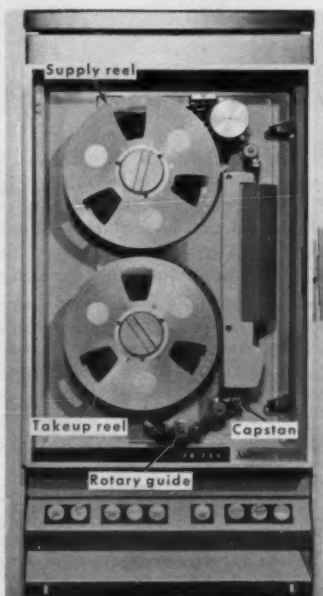
The belt planetary system is smoother and more compact than the conventional geared differential. Effectively, the servo control motor rotates the planet wheel about the output shaft, which receives its base speed and driving torque through a belt transmission from the synchronous drive motor. Since the output

shaft speed is maintained constant relative to the planet wheel, the latter may be rotated either forward or reverse to add or subtract to the base synchronous speed. Thus, it corrects output shaft speed to some desired value according to input signal.

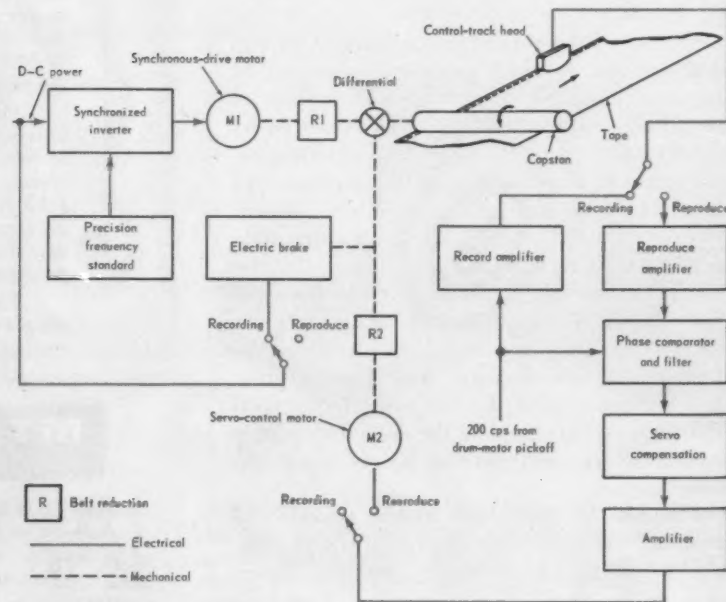
During reproduction from a magnetic tape, speed is sensed from the control track introduced during the recording operation. During the recording operation, a solenoid-operated electric brake locks the servo control motor pulley, and the capstan is driven at constant speed by the synchronous motor. In reproduction, the electric brake is released and the servo control motor operates to correct speed according to the control track head signal.

The capstan servo system, utilizing the planetary differential, is a design development of Ampex Corp., Redwood City, Calif., and is utilized on the FR-700 wide-band magnetic tape system.

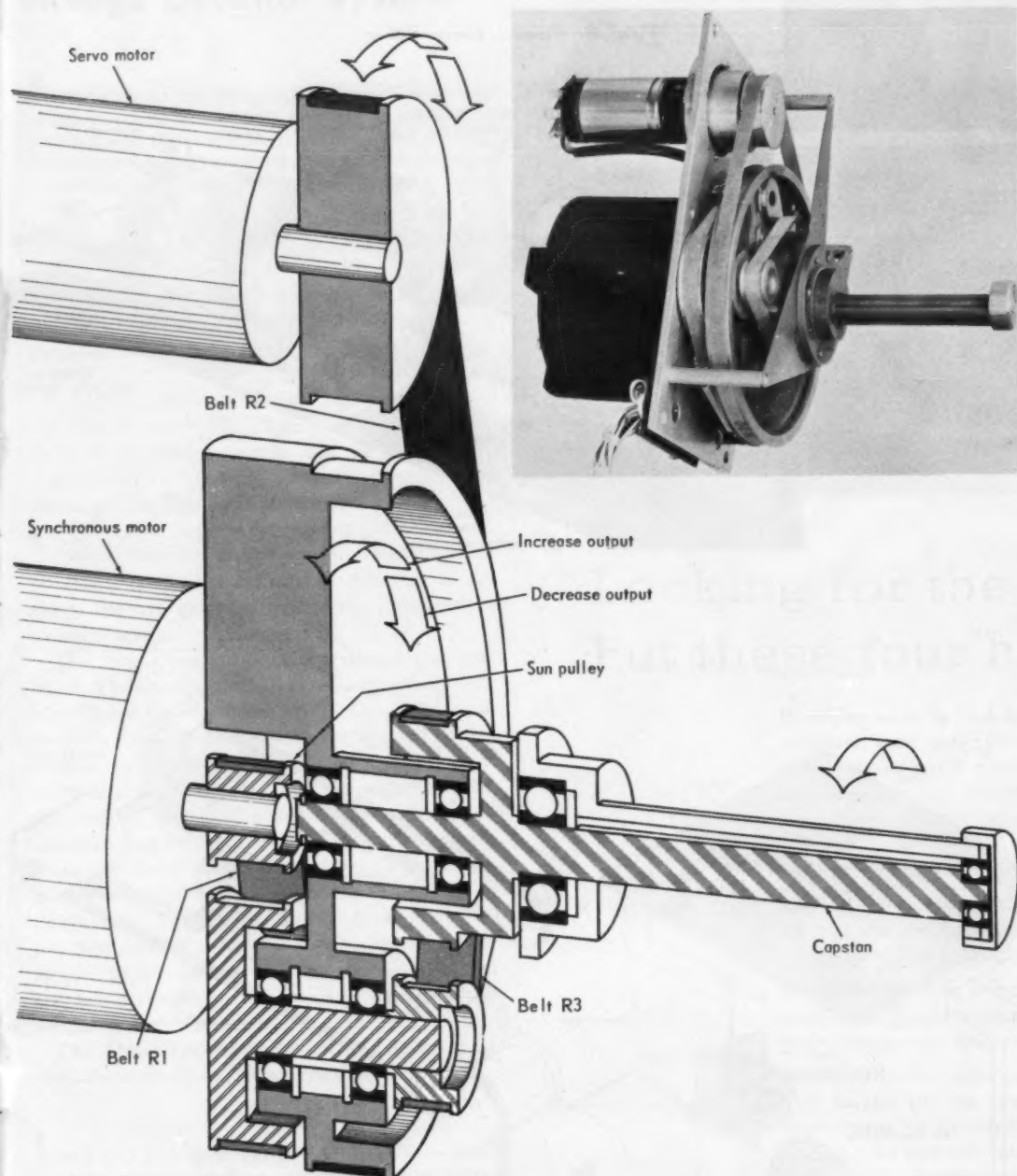
► **BLOCK DIAGRAM** illustrates method of generating control-track signal which is applied to servo control motor. Motor, M2, introduces speed correction through belt R2 into planetary differential during "reproduce" operation only. Synchronous drive motor, M1, drives capstan through belt system R1 and planetary differential which acts as summing point of speeds. Electric brake is energized in "record" position only and locks out servo control motor, M2, when brake is energized. Interlocked switches change control track head signal from "record" amplifier to "reproduce" amplifier.



TAPE-HANDLING SYSTEM utilizing capstan servo system for drive. Since airborne version is used only for recording, servo control motor and belt drive R2 are omitted; planet wheel is locked in place. Speed-control feature is included on ground support unit for reproduction use.

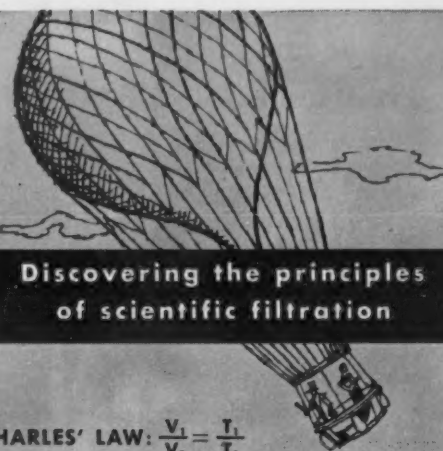


Controls Speed in Tape System



PLANETARY DIFFERENTIAL sums speed of synchronous drive motor with servo control motor. Two belts, R1 and R3, reduce speed of synchronous drive motor to output shaft. Bearings supporting driven pulley from belt R1 and driver pulley for belt R3 mount inside of pulley driven by servo

control motor by means of belt R2. These pulleys move as planets about sun pulley which is synchronous drive motor pulley. Entire housing for these pulleys is the driven pulley of belt R2. Thus, servo control motor's speed influences speed of output shaft.



Discovering the principles of scientific filtration

CHARLES' LAW: $\frac{V_1}{V_2} = \frac{T_1}{T_2}$

"Gases under constant pressure expand in equal proportion from the same temperature for equal temperature increments."

Jacques Charles (1746-1823)

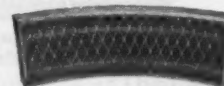
Through his interest in ballooning, French physicist Jacques Charles, in 1787, determined that the pressure coefficients of expansion of all gases are the same. Further study by Gay-Lussac in 1802 revealed that all gases have the same volume coefficient of expansion; later Regnault observed that the increase in volume per degree centigrade was 1/273 of the original volume.

Similarly at Air-Maze, constant research and testing establishes new principles to improve filtration. For 35 years Air-Maze engineers have worked together pioneering new industrial filtration products based on the findings of Charles and others. The result is a complete line of specialized industrial filtration products for every situation involving the movement of gases and liquids.

Shown below are representative products developed by Air-Maze engineers to keep equipment clean and free from damaging contaminants for longer, better operation.

Liquid or Air Filters—from missiles to private aircraft there is an Air-Maze filter to meet your requirements.

In-line Filters—small, lightweight. These filters are used in missile hydrazine fuel systems.



Permanent Cleanable Panel Filters—for carburetor air intakes.

OTHER AIR-MAZE PRODUCTS:

Air Filters • Liquid Filters • Intake Silencers • Exhaust Spark Arresters • Breather Filters • Oil Mist Eliminators

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know-how in Zinc and Aluminum die casting design, engineering and production covers a wide range of component parts from small camera parts...



...to engine cylinders

Moreover, ADVANCE often solves a product sales problem by alert die casting engineering and skills which smooth-up product lines and appearance while at the same time improving casting cycles and lowering part costs.

That is why ADVANCE Zinc and Aluminum die cast parts are important components everywhere in home appliances, office equipment, power tools, gas engines, cameras, surveyors' instruments, electric motors and control devices.

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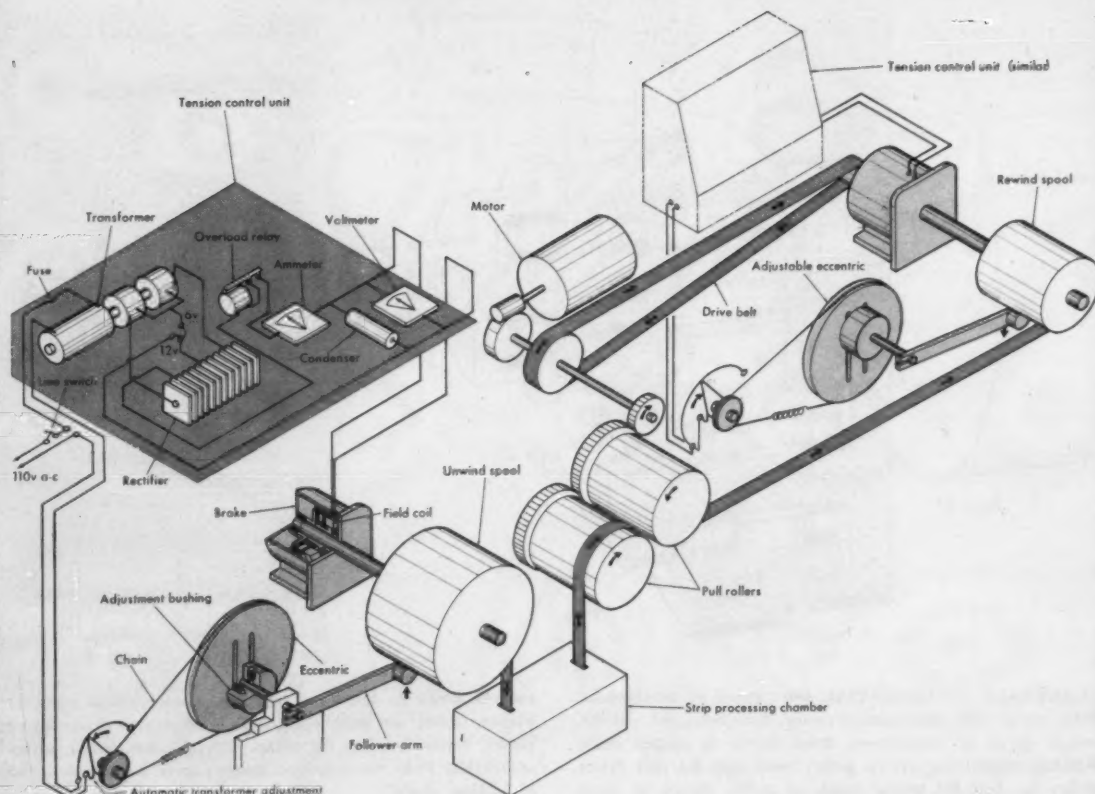
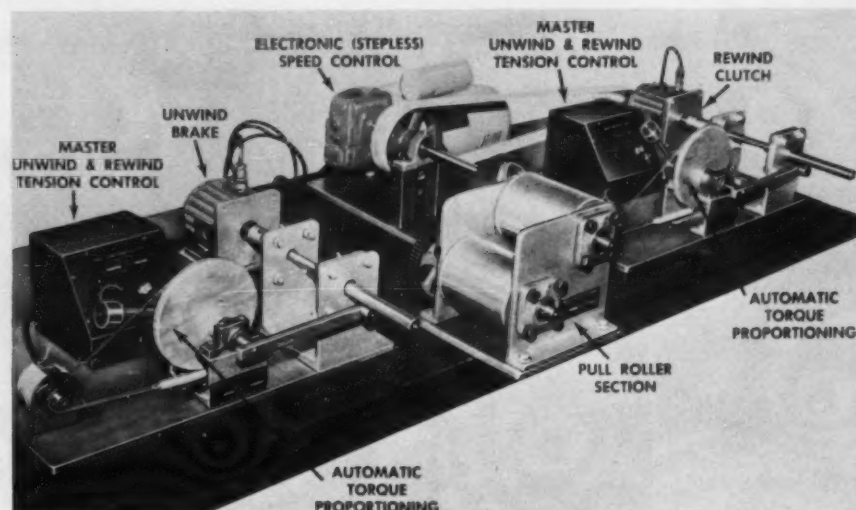
Gear Housings?

Product
Identifications?

IDEAS... CONTROL SYSTEMS

Adjustable Eccentrics Proportion Spool Tension

Victor W. Wigotsky, Eastern Editor



Circle 188 on Reader-Service Card for more information

through Electrical System

UNIT CAN BE USED FOR ANY WEB or filament, such as plastic, paper, metal and film. System is adaptable to processes such as curing, drying, laminating and printing. Torque-proportioning units and pull roller section may be mounted in various positions.

Adjustable eccentrics and electrical circuits function as automatic torque proportioners in a web-control system. The eccentrics progressively adjust the voltage to individual transformers to satisfy independent unwind and rewind requirements.

Material passes through a strip processing chamber between the unwind and rewind sections. It is often necessary that, in addition to correcting for the changing spool diameters, rewind tension vary from that before the material was processed.

Independent but similar tension control systems provide the desired adjustable differential between the two spools as well as the independent constant tension requirement.

The torque proportioner is a slotted eccentric which is positioned easily with an adjustable bushing. The eccentric moves with changes in position of a follower which contacts the spool's outer surface. Eccentric motion results in adjustment of voltage to the control unit's transformer. On the unwind side the adjusted voltage is fed to an oil-shear magnetic brake to maintain a constant tension as spool diameter decreases. The process is similar on the rewind side of the system except that a clutch is substituted for the brake. The simple web control thus provides easily adjustable torque proportioning to suit specific material processing requirements as well as differing widths and thicknesses.

The Marco-1 Control System was designed by Web Controls Corp., West Englewood, N. J.

CONSTANT TENSION UNWIND SPINDLE is controlled by brake as proportioned by follower arm, which follows decreasing diameter of web to turn eccentric. Spring-loaded chain and eccentric adjust voltage transformer and thus proportion coil current in brake through a-c/d-c converter. Master tension adjustments are made in control unit by operator. Pull rollers are powered by variable d-c drive. Rewind spool is proportioned similarly by follower as web diameter increases.

NAT'S
quick facts
about
Fasteners...



MARSDEN



HUGLOCK



CONELOCK



DRAKE

Looking for the **right** lock nut? Put these four high on your check list

By taking an early look at these National all-metal lock nuts, you may often be able to make quick work of finding the locking member that best meets the requirement of your particular job.

Once over lightly, here are the advantages they offer you.

MARSDEN—For minimum cost and average conditions. Free-running until seated. One-piece, fully re-usable.

HUGLOCK—For use under adverse conditions. Locks without seating. One-piece design, and fully re-usable.

CONELOCK—For applications requiring high-fatigue life, as assured by closed stress paths in Conelok's locking sections. Locks without seating. One-piece design, and fully re-usable.

DRAKE—For use under severe stress, shock or vibration. Free-running until seated, or can be locked at any point by using two wrenches. Two-piece design, and fully re-usable.

Take a good look at all four, and at the advantages they may be able to offer in your product assemblies. You may not be thinking of an application right now, but get the literature* and keep it handy in your files, just in case.

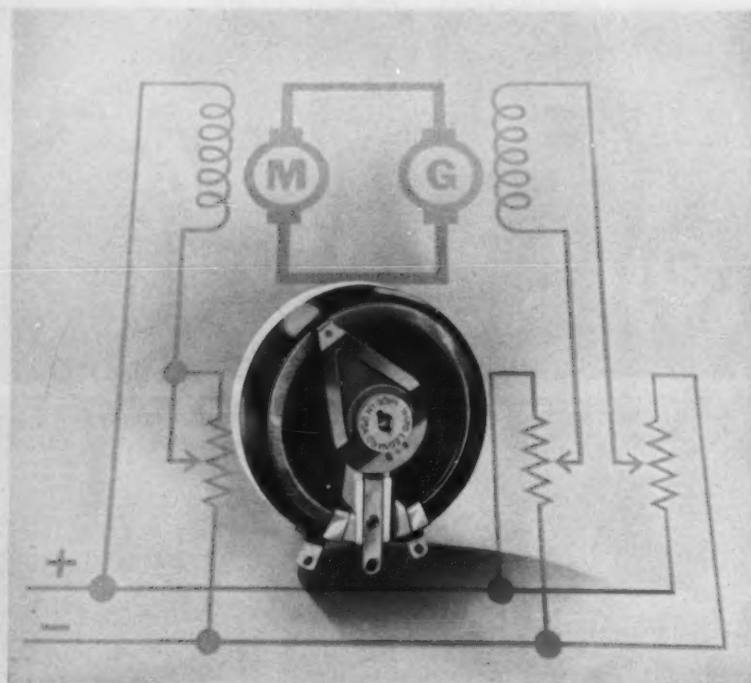
*There's a folder on the Conelok, and a booklet on the others. Write for your copies.



The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

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Background is schematic of world-famous Ward Leonard system of control.

In modern rheostat circuits, it's SERVICE CONTINUITY THAT COUNTS

Production stopped. Workers idle. But wages, maintenance costs, and fixed charges go merrily on accumulating.

That's the black picture when an industrial control component—specifically a rheostat—fails. That's why reliability is more important than initial cost. In many cases, these irrecoverable charges and costs can quickly far exceed the replacement cost of the faulty components.

And that's why far-sighted designers are more and more specifying Ward Leonard VITROHM ring rheostats for control circuits where performance is a must...in motor and generator field control circuits...for electronic tube filament circuits...wherever substantial amounts of power must be handled with utmost rheostat reliability.

Ward Leonard ring rheostats, in sizes of 25, 50, 100, 150 and 300 watts, feature W/L's exclusive "twin contact shoe" design. Two sintered, self-lubricating contact shoes minimize wear and assure uniform contact pressure, smooth oper-

ation, and maximum reliability.

Special alloy resistance wire—made to W/L's closely monitored specifications to assure highest stability and lowest practical temperature coefficient—is bonded permanently to ceramic core by Ward Leonard's own VITROHM vitreous enamel.

These are just a few of the reasons why VITROHM ring rheostats give you outstanding reliability in industrial control circuits. There are many more quality-engineered features than we can describe here—for instance, highest grade ceramic base and core, durably bonded tinned alloy terminals, and balanced beryllium copper contact arm. You'll find them all in Bulletin 60RR (and for powers above 300 watts, check W/L plate rheostats in Bulletin 60A). For your copy, and for a list of stocking distributors, write: Ward Leonard Electric Co., 26 South St., Mount Vernon, N.Y. (In Canada: Ward Leonard of Canada, Ltd., Toronto.)

o.s



WARD LEONARD
ELECTRIC CO. MOUNT VERNON
NEW YORK

RESISTORS • RHEOSTATS • RELAYS • CONTROLS

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NEW BOOKS

WHY ARE RUSSIANS AHEAD OF US IN ROCKETRY? WHAT CAN WE AND WHAT ARE WE DOING TO NARROW AND OVERCOME THEIR LEAD? Two and three years after the first Sputnik, America conceded that the Soviets were still ahead in rocket thrust, while the United States led (small consolation) in color television. It is true, we admit, that in the celestial basketball game aimed at the moon, the Russians not only exceed us in weight but also anticipated us by two months. In **RUSSIA'S ROCKETS AND MISSILES**, Dr. Albert Parry, one of the first experts on Russia to draw America's attention to Soviet work in rocketry, presents a dramatic account of Russian efforts to master outer space. New light is thrown on how captured or hired German scientists contributed to

Russian rocket success after the war, and Soviet military use of rockets and the Soviet IRBM now being installed on Russia's powerful submarine fleet. The story of the Sputniks and Luniks and Russia's plans for peaceful use of rockets and missiles are also illuminated in this 382-page publication. Doubleday and Co., Inc., 575 Madison Ave., New York 22, N. Y.; \$4.95.

(Editors note: "Has America any real answer to all this Khrushchevian rocket-rattling?")



MARVEL Synclinal FILTERS

Answer
DESIGNERS S.O.S.

For Dependable Protection on All
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Balanced Design . . . is the answer to the growing preference for MARVEL Synclinal FILTERS. Designers are specifying Marvel Synclinal Filters to assure minimum maintenance and maximum protection. Results show Marvel Synclinal Filters superiority in maintaining the greatest degree of cleanliness of liquids in all hydraulic and low pressure circulating systems. When filter servicing is necessary, Marvels can be easily disassembled, cleaned and reassembled in a matter of minutes. Line types operate in any position and may be serviced without disturbing pipe connections.

OVER 900 ORIGINAL EQUIPMENT MANUFACTURERS
NOW INSTALL MARVEL SYNCLINAL FILTERS AS
STANDARD EQUIPMENT.

IN-LINE FILTER

Handles up to 25 G.P.M. of hydraulic oil at very low pressure drop. Monel wire cloth filtering media in mesh sizes from 30 to 200. Cartridge is easily removed for cleaning.



SUMP
TYPE
(Cutaway)

Meets
J.I.C. Standards

LINE TYPE
(Cutaway)

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be obtained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY

Catalogs contain dimensional charts and complete engineering data making it easy to order a filter for your specific requirements and get immediate delivery.

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wire, phone or use coupon below.

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ENGINEERING PROFESSIONALISM IN INDUSTRY.

"One out of four engineers in industry believes that engineers are thought of as second class professionals; but no industrial managers agree with this opinion."

"More than half the engineers in industry think that higher pay would advance the engineering profession; but only 20 percent of industrial managers agree."

These are some of the findings reported in a 104-page survey made by Opinion Research Corporation and available from National Society, 2029 K St., N.W., Washington 6, D. C., priced at \$2.00 for members, \$4.00 non-members. Primary objective of the study was to find out what engineers and engineering managers mean by professionalism, and how they think it can best advance. Interviews brought out that 90 percent of managers questioned stated that they regarded engineers among employees making most valuable contribution to company. Less than half of engineers felt that they were so regarded by management. Survey findings were based on 350 personal interviews. Engineers all hold college or advanced degrees in engineering and are employed in recognized engineering assignments. Managers include directors for industrial relations, vice-presidents for production, production managers, chief engineers or managing engineers, project engineers and coordinators.



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NOW!

Adjustable Diameter and Open

THOMSON BALL BUSHINGS



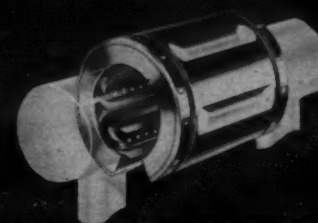
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**LOW FRICTION • ZERO SHAKE OR PLAY
ELIMINATE BINDING AND CHATTER
SOLVE SLIDING LUBRICATION PROBLEMS
LONG LIFE • LASTING ALIGNMENT**

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Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

The various types cover a shaft diameter range of 1/8" to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

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With "Crown" remote controlled units, you can filter and drain overhead air lines, control regulators from below, and fill lubricators without climbing. Or, with our completely standard units...

...you can provide just the right amount of filtered, regulated and/or lubricated air right at your machine.

NEW! PULSE-LUBE... for off-beat air flow

If air flow is uphill or light or so infrequent that air-borne lubrication won't solve your problem, you can deliver oil just where you need it, in the exact amount you need, through a tiny flexible tube with new "Crown" Pulse-Lube...

All these "Crown" developments are detailed and described in a new, comprehensive "Crown" catalog (our Bulletin 0400-B1).

We'll be happy to send you one.



HANNIFIN COMPANY

A DIVISION

535 South Wolf Road • Des Plaines, Illinois

PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

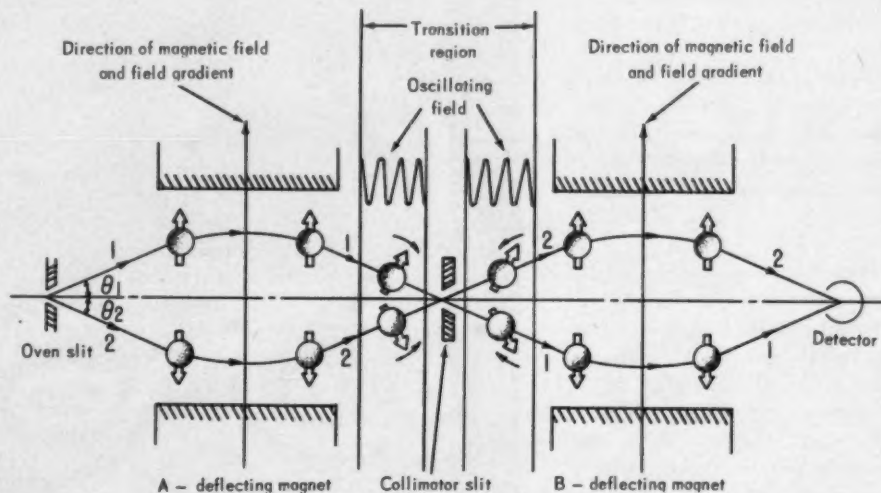
EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

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SCANNING PRESS RELEASES

• **CESIUM BEAM FREQUENCY STANDARD** has been constructed by the National Bureau of Standards during developmental research on the precise measurement of frequency. For radio communications, the tracking of satellites, the control of long-range rockets and as-

tronomical observations, timing accuracies of one part in a billion or better will be required in the future. The Bureau has been investigating atomic frequency standards which are potentially three orders of magnitude more precise for time-interval determinations than the rotation

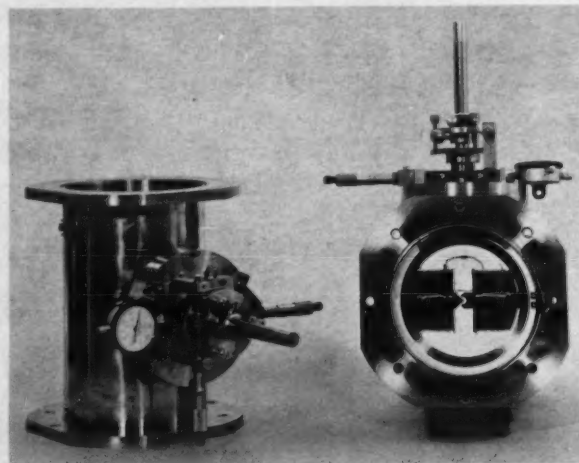


SCHEMATIC of atomic beam spectrometer. Trajectories are drawn for those atoms whose magnetic moments are "flipped" in transition region.

of the earth.

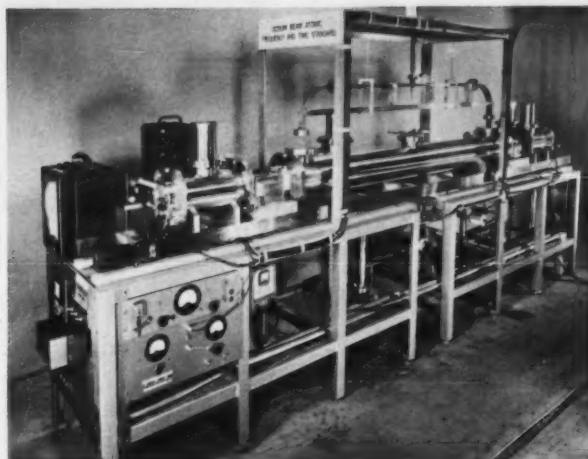
The frequency standard is essentially an atomic beam spectrometer excited by a crystal oscillator driving a frequency multiplier chain. The spectrometer puts out a signal only when the excited atoms go through a quantum transition. The

exciting signal from the frequency multiplier chain is designed to have a frequency very nearly equal to this transition frequency. Therefore, if there is an output from the spectrometer when it is excited by this signal generator, the frequency of the generator must be the same as the



DEFLECTING MAGNET ASSEMBLY for atomic beam frequency standard. Cesium beam passes between two circularly contoured surfaces of magnet pole pieces.

SEPARATION between oscillating fields inducing atomic transition is 164 cm. Spectral linewidth is 90-140 cps.



transition frequency of the cesium atom.

In practice, the signal generator is varied manually, or automatically over a narrow band to find the "center" frequency and when the spectrometer output is at a peak, the signal generator frequency is known within ± 0.2 cps or two parts in 10^{11} . Suitable automatic equipment could be used to control the

signal generator so that the spectrometer output would stay at the maximum, thus providing a signal of known and nearly constant frequency for as long as the device can be kept running. As the separations of the quantum states of an isolated atom are constant with time, they can be expected to provide a stable, reproducible standard of frequency and time interval.



• **LIGHT WEIGHT SWIMMABLE TRUCK** carries 5000 lb and will continue to "swim" even when completely flooded or shot full of holes. The truck uses thin sandwiches of honeycomb aluminum panels for the body and polyurethane foam in sponsons around wheel wells.

Designated the XM-521, the test vehicle has been designed to carry 16 men with equipment, travel up to 55 mph on the road and 5.2 mph in the water. In

addition, it will enter water bodies from slopes as great as 60 percent or from a sheer four-ft-high bank at virtually any speed. Since the vehicle can fill completely with water without sinking, it has a short rear overhang which permits the rear end to dip under water while climbing up a bank, thus permitting traction on a 60 percent slope.

The experimental body was developed by the Evansville Defense Div. of Whirlpool Corp.



Quick way to increase morale...step up efficiency

Hamilton "L" Contour Tables

PROVIDE A PERSONALIZED EXECUTIVE WORK AREA FOR EACH MAN

Make it easy for your top men to do their best work—every day. High morale and productive efficiency go hand in hand when you provide each man with the **Individual privacy** of a Hamilton L-CONTOUR TABLE. **Individualized private cubicles** offer modular, space-saving flexibility. **Single support** keeps board stable, perfectly balanced, readily adjustable from horizontal to vertical. **Generous storage** includes reference drawer, tool drawer, catalog drawer. **Glare-free** linoleum reference surface and a host of other features make the Hamilton L-CONTOUR TABLE a real investment in stepped-up productivity. **Write today** for full details.



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PROFESSIONAL AND SCIENTIFIC FURNITURE
Hamilton Manufacturing Company, Two Rivers, Wisconsin

new dimensions in time and space efficiency for: physicians; dentists; industrial, hospital, school laboratories; draftsmen; printers; libraries; home laundries.

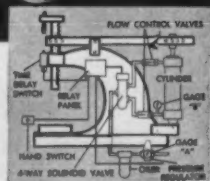


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PNEU-TROL

AUTOMATION TIME DELAY SWITCH

FOR CONTROLLED TIME
DWELL OF AIR OR
HYDRAULIC CYLINDERS



Arbor press converted to high production power press, using double end cylinder, Time Delay Switch, Flow Control Valves, and related equipment, Flow Valves permit independent ram speed adjustment in both directions. Differential pressure between "A" and "B" gauges caused by throttling effect of Flow Control Valve creates time interval in working pressure build-up, which is compensated for by Time Delay Switch setting. This insures consistently accurate working pressure on the ram.

- Holds dwell accurately to fraction of second
- Automatically re-sets
- Designed for millions of actuations

Pneu-Trol Time Delay Switch will hold any cylinder controlled motion or operation at a positive stop on either end of the stroke for 1/4 to 60 seconds in 20 to 1 ratios. Simple, easy to adjust. Automatically re-sets after each actuation. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of time dwell. Available with many thrust linkages for left and right, down, up, or horizontal thrust. Write for Special Bulletin TDS-59

AUTO PNEUMATICS INC.
2921 GRANT STREET
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NEW SELF-TAPPING*

SET SCREW
actually
"pulls itself in"

- Eliminates tapping problem!
- Increases product reliability!
- Cuts production cost!

You can completely eliminate the tapping problem while increasing product reliability with Setko Self-Tapping Set Screws! Exclusive, tool-sharp, cutting edges, located on the lower threads of the screw, actually cause the screw to "pull itself in"

—Shavings are gathered into the oversize slots... Holds securely even under extremes of vibration. You'll find they serve equally well to clean out painted holes or as reaming screws. Can be reapplied many times without loss of cutting or holding ability.

SEND FOR FREE TEST SAMPLES TODAY...

Tell us your requirements and we'll forward full information and recommendations, along with your samples, free of charge.

*Patent pending

SETKO Set Screw
147 Main Street, Bartlett, Illinois

We specialize in solving tapping screw problems

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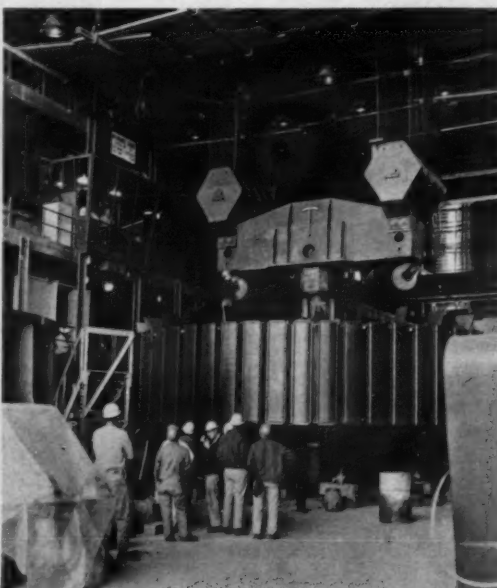
RELEASES...

• **GANTRY CRANE**, claimed to be the world's largest, is hoisting, transporting and placing the huge components of the Robert Moses Niagara Power Plant. Overall dimensions of the 630-ton crane are 70 ft high, 63 ft wide and 95 ft long, bumper to bumper.

The crane stands on 24 wheels which carry it along steel rails running the length of the dam-site and erection bay. The structure is steel with interlocking aluminum-slat paneling on the upstream and downstream sides and rolling aluminum doors at either end. By lowering the electrically operated doors, the crane provides a 2303-sq-ft, weathertight working area.

Two eight-wheel trolleys support the lifting beam. Mounted on each trolley carriage is a hoist assembly consisting of an 84-inch dia hoist drum and the upper sheave block. Lower sheaves are connected to the lifting beam. Each hoist drum is driven by a 150-hp motor and equipped with twenty-four 1 3/8-inch-dia wire ropes.

The welded-steel lifting beam spans the two lower hoist blocks. A special, 600-ton forged steel, swivel-type hook is mounted at the center of the lifting beam. At each end of the beam are 65-ton forged-steel, swivel-type, single-safety-latch hooks. Forged-steel pins connect the hook



GANTRY CRANE must position 590-ton generator rotor inside pit-mounted stator that provides only 3/8-inch clearance all around. In addition, the crane must position rotor to engage keyway and simultaneously align 24 shear pins with mating holes in stator frame.

HAGEN repeat cycle timers...

FOR INTERRUPTING
ELECTRIC CIRCUITS
AT A PRE-ARRANGED
TIME SETTING

- ★ Split Cams for variable percentage setting
- ★ Time cycles from 1 sec. to 60 min.
- ★ Contact Rating 15 Amps. at 115 V. AC. 7.5 Amps. at 440 V. AC.

Ideal for grease injection, motor control, humidifiers, signal lights, pulsing circuits, vending machine and appliance control. One and two circuit models available.

Write for Bulletin 1310 for complete specifications and types available. Address Dept. DN-261.

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Low-cost... Wilkerson MINIATURES...



filters
regulators
lubricators
designed
specifically to
**SAVE
SPACE**

Proven to be the finest by hundreds of OEM users!

"**WILK-O-MATIC**" **FILTER** Automatic drain • Up to 40 CFM • Removes 5 micron particles • 300 PSI maximum.

"**DIATROL**" **REGULATOR** Large flows • 3 outlet ports • Non-chattering, self-relieving • 300 PSI maximum • 0-50, 5-125 or 10-250 PSI ranges.

"**ATOMIZER**" **LUBRICATOR** Up to 75 CFM • Site Flo Gauge and 2 fill holes • 250 PSI maximum • Starts lubricating at 1 CFM.

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Dedicated to keeping the NEW in PNEUMATICS

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DESIGN NEWS—FEBRUARY 13, 1961

yokes to the lifting beam and permit rotation of the hooks.

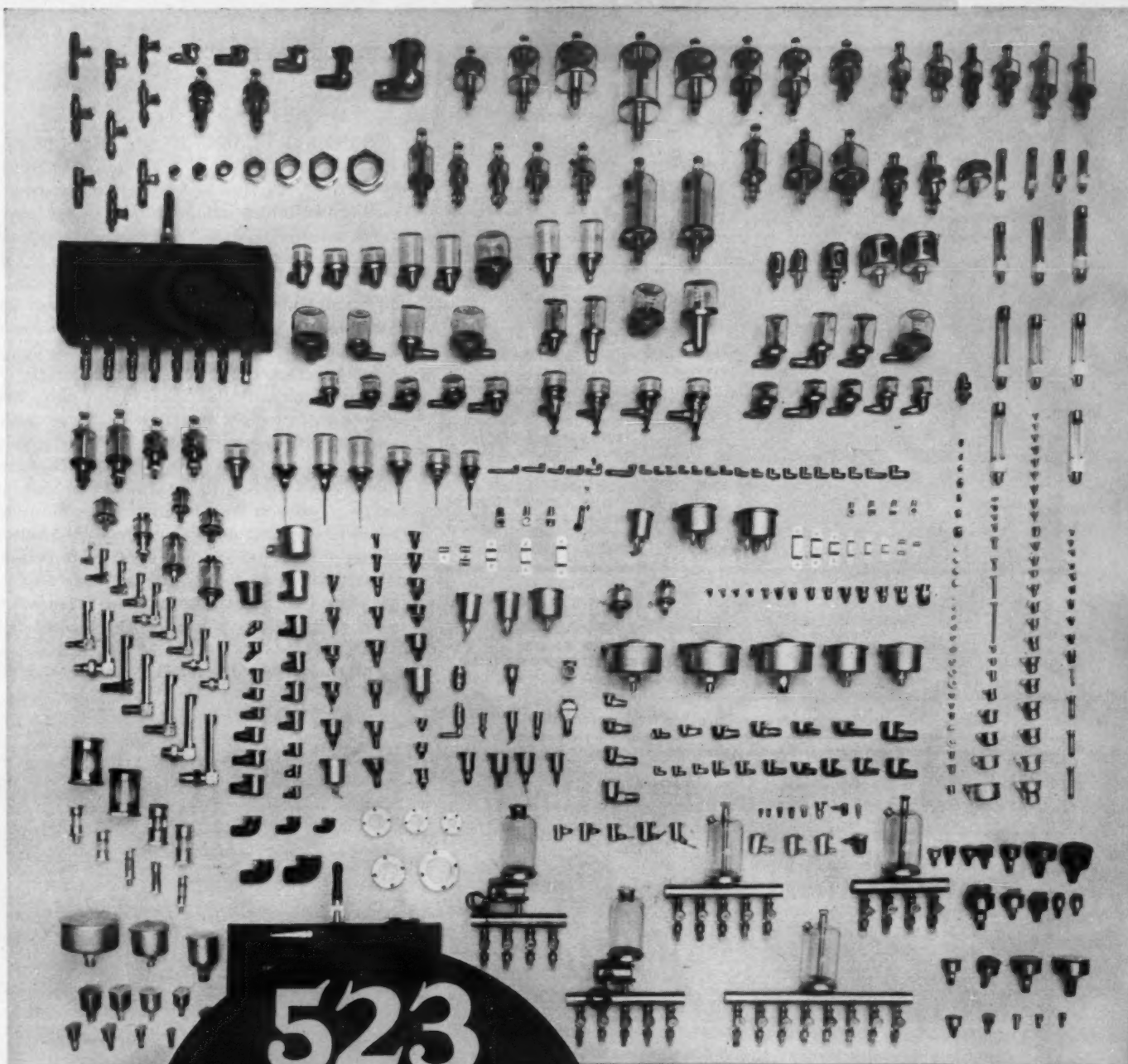
Two power-supply collector systems—one for use within the erection bay and a second for use on the generator deck—are used. To maintain a continuous electrical supply when the crane is moving between the two independent conductor systems, an upper collector arm is located on one side of the crane and a lower collector arm on the opposite side. The system permits automatic sequencing of the dual main breakers and collector arms so that one arm makes contact before the other breaks contact with its respective conductor system.

Four 50-hp electric motors power the gantry at speeds up to 150 fpm. Maximum lift of the crane is 90 ft. Top hook speed is 5.4 fpm with creep speeds to zero for close-tolerance lowering. Maximum trolley speed is 15 fpm.

Supplementing the main hoist is an integral monorail hoist system located below the main trolley girders. This hoist is used for handling light loads within the gantry's working area. The monorail forms a large loop within the supporting legs of the gantry to give access to the 47 ft by 49 ft working area within the confines of the gantry structure.

In addition to its traveling loop, a retractable jib boom is provided to allow the monorail hoist to move outside the limits of the gantry and transport equipment to and from the working area. The monorail is equipped with an operator's cab but also can be controlled remotely from the gantry's main cab.

The crane went to work in mid October when it lowered into place the first of 13 rotors for 150,000-kw Westinghouse generators. It was designed and built by the Milwaukee Crane Div., Novo Industrial Corp., Cudahy, Wis.



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AND GAUGES
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SHIP

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Lubricating Devices and
Shaft Seals for Almost
Half-A-Century*



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3 STEPS TO EXCELLENCE IN PW BOARDS

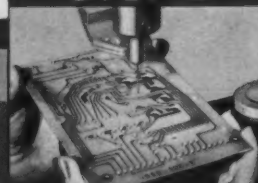
STEP 1



FUNNEL FLANGE EYELETS

Only the United Funnel Flange Eyelet contributes that greater mechanical strength, improved reliability and uniform circuitry so necessary for achieving a superior PW or Etched Circuit Board. Wide range of sizes and lengths meet all board needs.

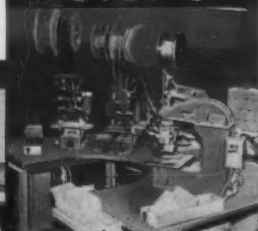
STEP 2



AUTOMATIC EYELETING MACHINES

Only United offers such a complete line of Eyelet Setting Machines, backed by more than 50 years' experience with precision production machinery for industry. The United Model G Eyeletting Machine feeds eyelets automatically, compensates for variations in board thicknesses for more dependable production.

STEP 3



COMPONENT INSERTING MACHINES

Only from United — a complete line of high precision DYNASERT Component Inserting Machines that cut component inserting costs up to 80%!

DYNASERT Machines automatically feed, trim, bend leads, insert components and clinch with uniform results. If you insert only a few hundred components a week DYNASERT machines should be considered.

These "3 Steps to Excellence" — Funnel Flange Eyelets, Automatic Eyeletting Machine, and Component Inserting Machines . . . can provide that vital extra margin of dependability and value in your PW or Etched Boards. And the investment is surprisingly small. Call or write for complete details.

United
UNITED SHOE
MACHINERY CORPORATION
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Don't let these Devils INTERFERE with OPERATING PERFORMANCE



Troublesome maintenance and lubricating problems are eliminated when you specify Thomas "All-Metal" Flexible Couplings to protect your equipment and extend the life of your machines.

Like a thief in the night an inadequate coupling causes wear and damage to your machines — resulting in high maintenance costs and costly shut-downs.

UNDER LOAD and MISALIGNMENT
only THOMAS FLEXIBLE COUPLINGS
offer all these advantages:

- Freedom from Backlash
- Torsional Rigidity • Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection while in Operation
- Original Balance for Life
- Unaffected by High or Low Temperatures
- No Lubrication • No Wearing Parts
- No Maintenance



Write for Our New Engineering Catalog 60
THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

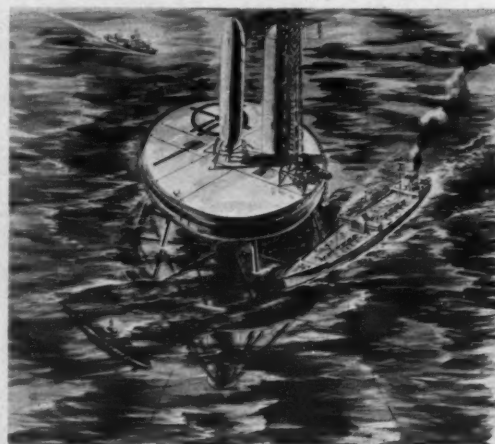
Circle 201 on Reader-Service Card for more information

RELEASES...

• **PLANETARY ROCKET OCEAN PLATFORM** has been proposed as a solution to future launching of chemical and nuclear rocket boosters. The platform is a buoyant sea-base for fabricating, assembling, static testing and launching large rockets or space vehicles.

The artist's drawing shows a nuclear rocket ship about 40 ft in dia and 300 ft long, ready for launching. Its launching platform is well above the reach of extremely high seas and is supported by an underwater buoyant chamber far below the wave forces of such seas. Supply ships are also shown in proper proportion. The versatile crane on deck hoists materials from the supply ships, functions as a prelaunch servicing platform and carries a cocoon to insulate the vehicle, if necessary, prior to launch. To avoid exposure to radioactive contamination and residual nuclear activity, a submarine is used to evacuate personnel through an air lock in the sub-surface structure after a nuclear launching. The ocean water serves as an effective blast shield for the hot exhaust.

This concept was developed by Aerojet-General Corp.



• **TRANSISTORIZED DIGITAL CLOCK** operates from a 100-kc input and provides an output in hours, minutes and seconds on a 24-hour basis. The clock contains a counter and a frequency divider. A record-rate interval control enables a pulse to be generated for system control at preset intervals. The 24-hour time output is suitable for driving a teletype high-speed tape punch and may be in either decimal or binary-coded decimal form.

Called the DC-116, the clock was designed by the Datex Corp., Monrovia, Calif.

TORQ SPEED DETECTION CONTROL

...may solve
YOUR problem

✓SIMPLY
✓POSITIVELY
✓ECONOMICALLY



• A single TORQ SYNPRO-TEX governor cycles an automatic washer during spin-dry to less than 1G to more than 1G to balance the load, get clothes drier and make the wash "fluffy".

• A TORQ MULTI-TECTOR practically runs a diesel engine. It cuts out cranking motors, engages and disengages cooling circuit, provides fuel requirements at different speeds, then signals full speed.

• TORQ governors relate fuel supply to air supply in power gas burners. A single governor will purge the combustion chamber, then turn on the gas, and during operation if blower falls below required speed for any reason, the governor shuts off the gas.

• In event of overload on a saw mill, due to dull blades, a TORQ governor causes the cutting blade to be withdrawn before damage can occur.

• On electronic equipment blowers, a TORQ governor will cut the equipment out of the circuit in event of blower failure, to protect expensive electronic components against overheating.

• Conveyors are automatically shut off if they fall below predetermined safe speed.

• TORQ governors make an ideal plugging switch to cut out the motor at low speeds close to zero before motor reverses.

• On truck refrigerators, TORQ governors maintain proper voltage and frequency output from the alternator by shifting it through a solenoid actuated transmission at pre-calculated truck engine speeds.

If your device employs a rotating shaft, a TORQ governor can sequence it, control it, provide signals, or monitor it for safety at one or many speeds from zero to more than 15,000 rpm.

Write today for Bulletin No. 250.

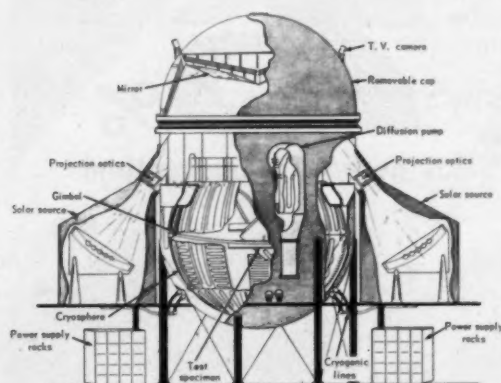
Patents & Patents Pending

TORQ ENGINEERED PRODUCTS, INC.
30 West Monroe Street Bedford, Ohio
Phone: BEdford 2-4100

Circle 202 on Reader-Service Card

• **SPACE SIMULATOR** with a "cold sun" as well as a combination of duplicated space conditions for the testing of full-sized space vehicles is being constructed for the General Electric Co. A special solar system will provide a large-sized collimated sun source. The cold sun effect will be achieved by the design of a 22-ft mirror which will beam energy on a test vehicle but will deflect all energy transmitted toward it to the cryogenic walls.

Like the real sun, the simulator's energy source will transmit up to 140w per sq ft in a uniform beam 20 ft in dia. The design of the solar system's optical components will also make the artificial sun appear to be the same distance away from the earth as the real sun.



Four banks of 5-kw xenon compact arc lamps will direct energy through optical lenses to the simulator sun mirror. Solar energy rays from ultraviolet to infrared will be produced by the lamps.

Maximum reduction of pressure inside the vessel will be 10^{-9} mm Hg. This will be obtained by pumps in a maximum of four hours. To obtain this low level, four types of pumps will be used—mechanical roughing pumps, diffusion pumps, nitrogen and helium cryogenic pumps—with a combined capacity of 70 million liters per sec.

Wall temperatures as low as 20K will cause condensable gases to collect on black aluminum wall panels and reduce the pressure to the low level. A space vehicle as large as 20 ft in dia or length, weighing as much as five tons, may be tested in the simulator for as long as 2000 hours.

The space simulator was conceived and designed by General Electric engineers and scientists in cooperation with scientists from the University of California, Spectrolab, Inc., and Pennsylvania State University.

It's new! HUNT ONE INCH PDQ VALVE

TOPS in accessibility
TOPS in simplicity
TOPS in speed
TOPS in capacity
TOPS in quality



Cylinder parts front, side and bottom-tapped; supply and exhaust ports side and bottom-tapped; basic 1 in. PDQ available tapped $\frac{3}{8}$, 1 or $1\frac{1}{4}$ in. NPT (also basic $\frac{1}{2}$ in. PDQ tapped $\frac{3}{8}$, $\frac{1}{2}$ or $\frac{3}{4}$ in. NPT); for air or vacuum service, pressures from 0 to 125 psig; meets JIC Standards.

Now you can have all the performance-proved advantages of Hunt's PDQ center-line design PLUS the high capacity of full 1" size. The PDQ's short stroke pilot and compact, lightweight, single spindle poppet provide lightning-fast response and near-instantaneous full flow. All this in a compact package weighing only 10.8 pounds!

Look at these performance figures. The 1" PDQ, with 100 psig supply, fills a 400 cu. in. vessel to 90 psig in but 0.288 seconds (17.3 electrical cycles) . . . exhausts the same vessel from 100 to 10 psig in 0.200 seconds (12 electrical cycles) and, at 100 psig, its flow capacity is 850 cfm free air!

Downtime? Short stroke, shock-reducing all-aluminum construction and built-in wear compensation assure millions of cycles of

trouble-free operation. Then, to repack, simply loosen 2 cap screws . . . twist pilot cap . . . remove pilot and valve housing. Piping is undisturbed . . . electrical connections are plug-in, wiring need not be touched.

If you're looking for better, lower cost, more dependable performance on new or existing equipment . . . before you buy any valve, be sure you see the PDQ. Call your nearby Hunt Representative today. He's listed in Sweet's Product Design File.

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VALVES

HUNT VALVE COMPANY • DIVISION OF IBEC • SALEM, OHIO

For more information, write for Bulletin 602. Address
Dept. DN-261, Hunt Valve Company, Salem, Ohio.

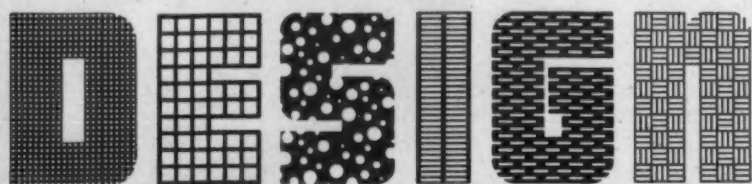
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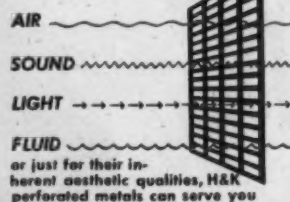
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one stands out!



AERO-SEAL JET® WORM DRIVE HOSE CLAMP

Designers know that sometimes even a relatively simple device is almost impossible to imitate, and AERO-SEAL has proved this point in the hose clamp field. The patented AERO-SEAL JET, for example, provides all of the advantages—including the security—of a precision worm drive clamp, yet permits almost instantaneous installation or removal. And AERO-SEAL bands and housings are of 302-18-8 stainless steel. All stainless also available.

AERO-SEAL solves countless fastening problems in electrical appliances, electronic, and chemical equipment. Complete range of sizes from 7/16" to 15 feet. Ask your industrial jobber.



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RELEASES...

• **ROCKET-BALLISTIC TOBOGGAN** enables pilots to safely "bail out" at ultrasonic speeds. The toboggan is now being installed in operational aircraft such as the F-106 Delta Dart.

Should the aircraft become disabled, the crewman pulls an emergency ring which triggers a fully automatic escape system. The automatic sequence includes: proper positioning of the man, removal of the canopy, lifting of the seat out of the cockpit, rotation of the seat on its back so the bottom absorbs all air blast, extension of long stabilizing booms and release of the seat from its carriage. The aerial toboggan is then rocketed away from the abandoned aircraft. The toboggan-like seat glides swiftly down in stable flight to about 15,000 ft where a parachute is deployed automatically to lower the man to the ground. The system is effective at any altitude including take-offs and landings.

The ejection seat is a result of a cooperative design program conducted by the Rocket Power-Talco Div. of the Gabriel Co. and the Convair Div. of General Dynamics Corp.



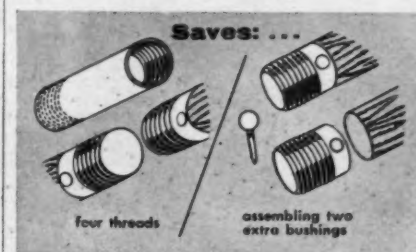
• **INTEGRATED AIRBORNE TELEMETRY SYSTEM** is capable of telemetering information from any of 30 switch closures and of 3 analog signals having frequency components from d-c to 2 kc. Telemetered information on switch closures is accurate in timing to ± 10 milliseconds and on analog signals to ± 2 percent. The integrated system, designed exclusively with solid-state devices, includes digital timing and storage circuitry, a transfluxor core analog-digital converter and a transmitter operating at a frequency of 235.5 mc and an output power of $2\frac{1}{2}$ w.

A design study of further system refinement indicates the equipment, exclusive of the power supply, could be packaged in a volume of 25 cu in with a weight of less than 2 lb.

The system was developed by The Missile Electronics and Controls Div. of RCA, Burlington, Mass.



over another method



ONE WAGNER SPACER used as a handle joiner



Butt Spacer



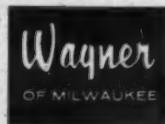
Spacer fastens bushing in wheel



Spacer in radiator or air convolver applications

A manufacturer of a home waxing device given to retail customers as a premium, sought a method of producing a low cost wooden handle for the waxer. Our engineers adapted a butt joint spacer to the job. The handle-joiner device, is illustrated above. Its butt joint, 180° slot, and center projection are all formed in one operation... a savings of approximately 76% over the usual machined threads and assembly method. This is just one example of how rolled, butt joint spacers save money on a wide variety of applications... often doing the work of two costlier machined fittings. Wagner spacers are available in: Lengths from 7/32" to 7"; I.D. from .100 to 2-1/16"; O.D. from 1/40 to 2 1/4"; Wall thickness .020 to .187. We also make a wide variety of brass, bronze, aluminum and steel spacers in "V" joint, diagonal or lock seam joints.

spacers for every application
write -- no obligation



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Manufacturing Co.
4619 N. 32 St.
Milwaukee 9, Wis.

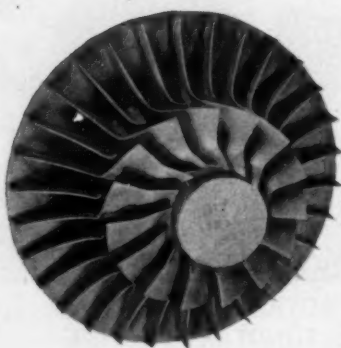
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Circle 206 on Reader-Service Card

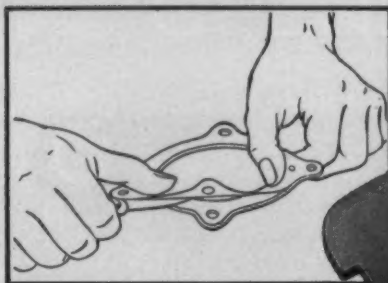
DESIGN NEWS—FEBRUARY 13, 1961

• **REDUCED INERTIA** and improved engine performance have resulted from use of magnesium compressor impellers in an automotive gas turbine now under development by Chrysler Corp. The regenerative gas turbine weighs only 450 lb.

Reduction of inertia in moving parts was necessary to reduce the acceleration lag. The turbine will have an actual engine acceleration lag of less than $1\frac{1}{2}$ sec from idle to rate output and an apparent vehicle lag under a second, which gives satisfactory car control.



Impellers were cast by the semi-permanent mold process from AZ91C-T6 using plaster cores for the blades. Excellent surface smoothness, necessary for aerodynamic reasons, was provided by the as-cast blade surfaces. Location of the blades was subject to ± 0.002 inch tolerance. Each blade is 0.025 inch ± 0.005 at the lower tip and tapers from 0.050 to 0.090 inch ± 0.005 at the upper tip.



Never underestimate the cost-saving advantages of **LAMINUM**®

We address this statement to design, tool, production, inspection and assembly engineers...

Holding to extremely close tolerances is a costly procedure. You know that. What you may not know is that frequently you can ease up on tolerances without sacrificing a single thousandth of your precise assembly objectives.

How? By using LAMINUM!

LAMINUM is the registered trade name for laminated shims whose layers are completely surface-bonded to look and act like solid metal. The layers are easily peeled to bring the shims to any desired thickness—for a thousandth fit right at assembly.

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savings carry over to the assembly line, too. No stand-by equipment. No machining. No grinding. No counting, stacking or miking. And no dirt between layers—ever!

Get the facts about cost-saving LAMINUM, and the custom-stamping service that goes with it. They're all illustrated and described in our Shim Design Folder No. 4. Write for it.



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2-SIDED ADHESIVES
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SAVE TIME AND MONEY IN ALL THESE OPERATIONS!

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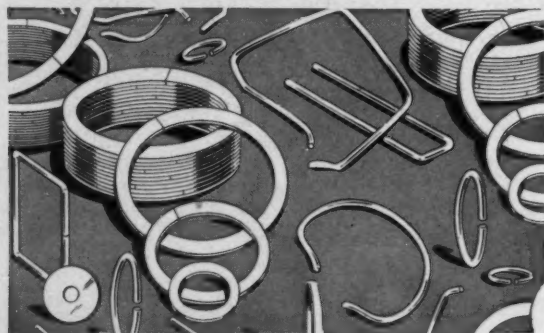
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RELEASES...

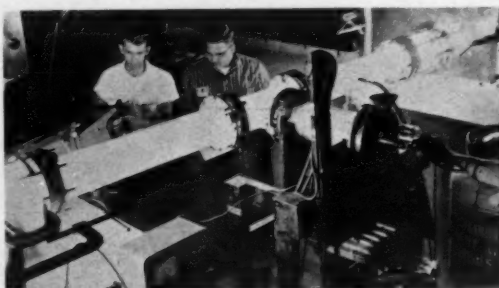
• **HEAD-ON COLLISION** of two shockwaves traveling 80 times faster than sound has been achieved in a hydromagnetic tube made of glass. The tube is 12 ft long and 6 inches in dia. Because the tube is transparent, still photographs can be taken of the colliding shock waves.

Shock waves are driven through the glass piping by a surge of electrical power. Electrical energy used to create the waves is stored in two 20-capacitor banks rated at 20,000v with a combined peak power of between 2,500,000 and 5,000,000 kw.

Once triggered, the shocks last only a few microseconds, but create a gas temperature within the tube of approximately one million degrees.

Velocity of the shock waves and spectra of radiation from the gas are recorded with a high-speed rotating mirror camera. A vacuum ultraviolet grating spectrograph—a device for separating light into its components—also is used to evaluate the data.

The equipment was developed by the Scientific Research Labs., Boeing Airplane Co. The glass tube was manufactured by Corning Glass Works from borosilicate glass.

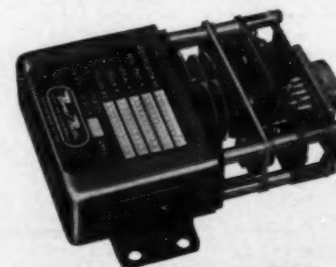


• **SIMPLIFIED ANTI-SKID CONTROL SYSTEM** automatically maintains sensitive control throughout the whole speed range from the moment of touchdown of an airplane. It provides protection against incipient skids and locked-wheel conditions, thereby reducing the danger of tire blowouts and permitting safer landings on wet or dry runways.

The system monitors wheel deceleration and acceleration by means of an a-c tachometer that feeds alternating voltage signals to a control box. A small pressure control valve provides braking pressure proportional to electrical input, but independent of fluid flow. Skid control is provided from the moment of touchdown to low forward speeds of 3 or 4 mph when desired.

The basic system to control four wheels weighs 4 to 6 1/2 lb, depending on the type of control valve used. It was announced by B. F. Goodrich Aviation Products.

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NORTH HOLLYWOOD, CALIF.



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• **100-WATT THERMOELECTRIC GENERATOR** will be used for cathodic protection of pipelines and for charging batteries of a microwave relay communications system. The thermoelectric unit is made up of two 50w sections stacked one on the other. Propane gas is burned in an assembly at the base of the unit and the hot gases pass through a central insulated chimney. A number of thermoelectric "couples" are mounted around the outside of this chimney, and they generate



electric power as the heat is transferred through them. The hot side of these couples operates at about 400C. Heat is dissipated through anodized aluminum fins to the surrounding air.

The overall unit weighs about 75 lb. Output of the basic generator is 11v at 10 amps, d-c. A static converter operating at about 88 percent efficiency changes this output to 48v at 2.1 amps, d-c.

The 100w unit was designed and constructed at the Westinghouse semiconductor department plant for the Northern Illinois Gas Co., Aurora, Ill.



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Miller Hydraulic Cylinders make impossible applications look easy. With Teflon Seals, Case-Hardened Rods (50-54 Rockwell C), Patented "Shel" Tubing End Seals, and other exclusive standard features, these cylinders are practically damage-proof, are ultra-dependable under pressure and temperature extremes, and provide leakproof sealing with ALL hydraulic fluids. Built to exceed J. I. C. Specifications, these cylinders are achieving new highs in production and operating economies in thousands of plants. Two great lines: Power-Packed Model H for 3000-5000 psi and Job-Rated Model J for 500-2500 psi. All bores, strokes and mounting styles. Big "Stock" selection for immediate shipment at substantial savings.

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Designers can now re-consider the use of bevel gears—due to the latest Gleason coniflex system of bevel gear proportions which we employ—to minimize gear mounting problems and for less trouble after assembly. Costs are less by this method, better finishes and smoother gear operations are a result, and because bevel gears are so efficient, they can now be used more extensively than ever before.

We can make bevel gears up to 3' in diameter with up to 16 diametral pitch for such products as instruments, power tools, differentials, appliances, and fishing reels. Process bevel gears are precision engineered, deliveries are prompt.

Send blue prints or specs for prompt estimates to the specialists in the Fine Pitch Field.



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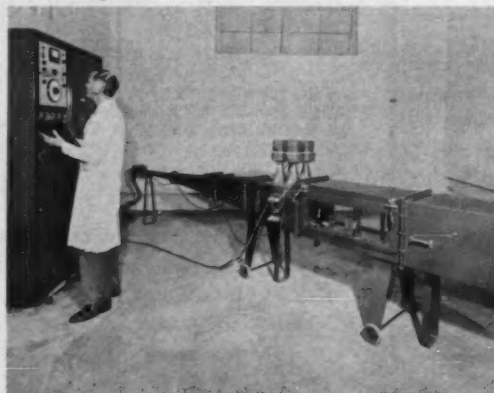
RELEASES...

• **U-3B** is an improved model of the earlier Cessna U-3A, which has been in use by the USAF since 1957. Thirty-five units have been ordered for administrative and light cargo missions. The U-3B is a five-place, twin-engine airplane and has a cruising speed of 220 mph. It is essentially the same configuration as Cessna's commercial Model 310F.



• **ACOUSTIC TEST FACILITY** permits testing of electronic components and subassemblies under actual acoustic conditions. An overall sound-pressure level of 160 db in a test area 1 by 1 by 3 ft is provided. The facility is designed to handle both explosive and non-explosive test samples and can be altered to provide combined vibration, temperature and acoustic environments as required.

The facility, presently being readied at American Laboratories Div., American Electronics, Inc., will be used to investigate the detrimental effects of high acoustic energies produced by missiles, particularly the Titan and Minute Man, in their underground silos immediately preceding launching activities.



6061-T6
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PLATE**



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ELECTRIC HEATING SPECIALISTS

Circle 215 on Reader-Service Card

DESIGN NEWS—FEBRUARY 13, 1961

• **MICROFILM COPIES** of pages of DESIGN News will be available at nominal cost. The film is in the form of positive microfilm and is furnished on metal reels, suitably labeled. Inquiries concerning purchase should be directed to University Microfilms, Inc., 313 N. First St., Ann Arbor, Mich.

• **GASES** superheated by ultrasonic shock waves to temperatures of 5000 to 21,000F are yielding basic data that may lead to design of new missile-detection systems. Experiments are being conducted in a new shock tube to test the reaction of superheated gases at simulated altitudes up to 150,000 ft. Temperatures such as those generated by a missile re-entering the earth's atmosphere are induced in the tube by shock waves traveling at 7 to 20 times the speed of sound.

The three-section wheel-and-rail-mounted shock tube consists of a driver; a segmented 20-ft-long, 3-inch dia steel test tube, and an expansion tank. The driver section is separated from the test tube by a copper diaphragm. The test tube segments are connected by instrumentation blocks.

In current experiments, the test section is evacuated and nitric oxide injected into it. The driver section is filled with helium at pressures up to 2200 psi. Pressure up to 8000 psi can be obtained by substituting a combustible gas mixture and igniting it.

At a given pressure, the copper diaphragm ruptures and sends the high-pressure gas rushing into the tube, causing a shock wave to travel along it. Velocity of the shock wave determines the temperature rise of the test gas.

The high-pressure gas also ruptures a "Mylar" diaphragm at the other end of the tube, where the heated gas spends itself in the expansion chamber.

Duration of a single test is from 20 to 100 millionths of a second. Results are obtained with special instrumentation, including gold-doped germanium and indium antimonide infrared detectors, with a response time of one-millionth of a second.

Instrument signals are amplified and displayed on an oscilloscope and the trace is photographed for later study.

The experiments are being conducted at the Convair (San Diego) Div. of General Dynamics Corp.

Maxitorq

STANDARD

floating disc

single and double clutches
or brakes

DESIGN PRINCIPLES OF THE 3 BASIC TYPES

The Maxitorq Clutch is completely assembled on the clutch body and shipped ready to slip onto a shaft. Separator springs . . . an outstanding feature . . . assure the advantages of truly floating discs. Used between each pair of inner discs, they spread them endways with an accordion action so that light can be seen between all discs when the clutch is in neutral. The floating disc feature makes certain that there's no drag . . . no abrasion . . . and consequently no heat when the clutch is in neutral.

A locking plate on the disc end of each clutch (two on the double types) locks all discs against tension developed by the separator springs. Manual adjustment is made by raising the lock spring, then turning the adjusting ring to give the desired shifting pressure.

Note that assembly adjustment and take-apart are all manual . . . no tools required.

Standard Maxitorq Clutches are available in single and double types, wet or dry . . . also in pulley and cut-off coupling types. Capacities to 15 h.p. at 100 r.p.m. Write Dept. DN for bulletin today.



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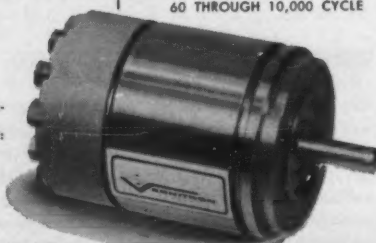
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ALL SIZES—8 through 23
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ALL ENGINEERED & MANUFACTURED TO:
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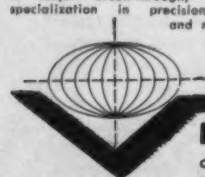
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 - High Reliability Exclusive Brush Block
 - Stainless Steel housings, shaft, bearings
 - High voltage capabilities between stator and compensator windings (on feedback units)
- A major break-through, made possible by VERNITRON specialization in precision synchro and resolver design and manufacture.



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tion data: ask for
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Missile tray made by Brooks & Perkins *beats target weight by 300 lbs.*



Air transported missiles require minimum weight handling equipment so that important defense weapons can be moved efficiently and on schedule. Recently, Brooks & Perkins was given the responsibility for engineering, designing, building the prototype and manufacturing an aluminum missile tray, shown above.

Unusual loading problems and the extreme importance of deflection required a dimensional tolerance of $\pm 1/32$ " in the 33-foot over-all length at 68°F. B & P not only met all tolerance requirements, but also reduced the initial target weight by 300 lbs.

The aluminum missile tray is another example of Brooks & Perkins skill and experience in the fabrication of light metal products for ground support equipment.

For more information and details of this and other GSE programs, write direct to Brooks & Perkins, Detroit.



BROOKS & PERKINS, Inc.

1936 W. FORT ST., DETROIT 16, MICH.
Offices in Washington and New York

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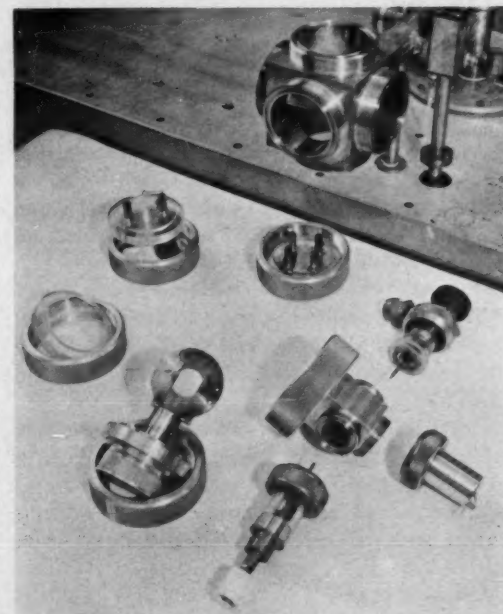
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RELEASES...

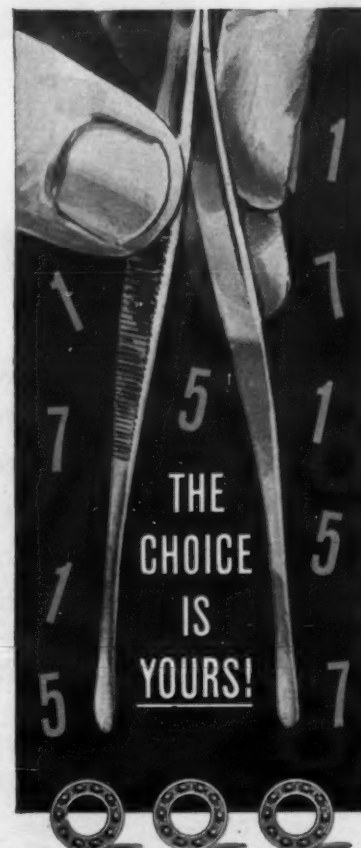
• **SMALL VACUUM CHAMBER** has been developed by the National Bureau of Standards for preparing the replicate specimens used in electron microscope studies. The vacuum chamber can accomplish a series of vacuum evaporations in rapid succession. A small volume may be evacuated to a pressure of less than 10^{-4} mm



UNIT FOR DEPOSITING CARBON is fitted to port on right. Metal evaporating unit is fitted to port on top.



APPARATUS for vaporizing dehydrated wetting agent is located directly under chamber body. Disassembled unit for carbon deposition, specimen stage attachment, port window and metal evaporating unit follow in clockwise order.



RMB

*RMB miniature and
instrument ball bearings
are available
in ABEC-1, ABEC-5
and ABEC-7 tolerances.*

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For highly sensitive and high speed applications you'll choose the RMB ABEC-5 or -7 bearing.

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IT'S YOUR APPLICATION— YOU MAKE THE CHOICE

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Ask for Catalog 4E-1.



LANDIS & GYR, inc.

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New York 36, N. Y.

Circle 219 on Reader-Service Card

of mercury in about seven minutes; an externally adjustable specimen stage permits the required angles to be obtained for a series of vacuum evaporations without reevacuating the chamber.

The chamber has several access ports to which attachments may be fitted for making different types of specimens.

In one method of preparing specimens for examination by an electron microscope, a dehydrated wetting agent is vaporized directly on the surface under study. Either a plain carbon or a pre-shadowed carbon specimen is then prepared by vacuum evaporation. The vaporized wetting agent facilitates the stripping of the specimen from the surface substrate.

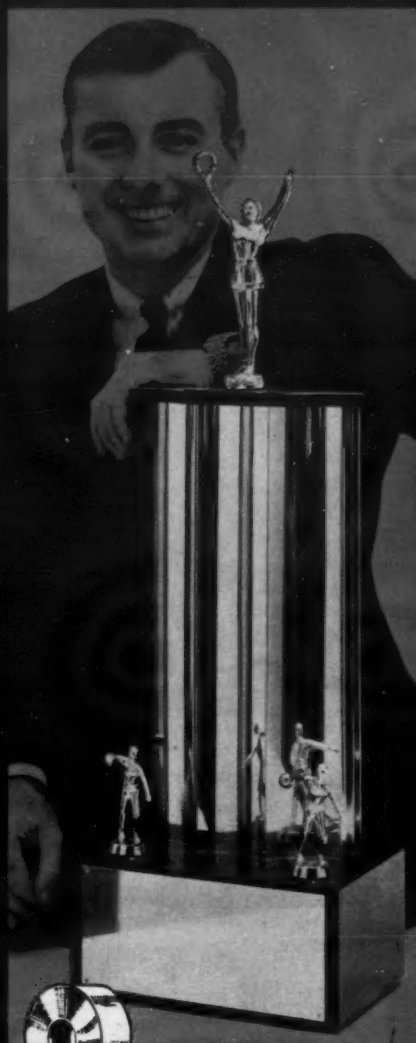
The vacuum chamber developed to accomplish these evaporations is made of brass in the shape of a cube, $4\frac{1}{2}$ inches square. Ports in five sides of the chamber accommodate interchangeable attachments. A port machined in the sixth side is adaptable to various types of evacuating units. Port windows are made of "Lucite" and O-rings are used to make tight closures. Epoxy adhesive is employed to seal electrical connectors into the various attachments.

The port opposite the evacuating system is used to admit a stage component on which several specimens may be mounted. After the chamber has been evacuated, the stage may be rotated manually to any desired angle with respect to remaining four ports. One of these serves as an observation window and two others accommodate attachments for shadow casting metals and for depositing carbon. The last port is fitted with a wetting agent fixture when a specimen is being prepared directly from the surface under study. When a plastic replica is used in preparing the specimen, this port may be fitted with an additional window for observation purposes.



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NICKELOID IS EVERYWHERE



ON THE MANTLE



ON CARPETING



ON THE PATIO



These eye-catching products use functionally a basic Nickeloid Metal. The finish of Chromium, Nickel, Brass or Copper is electroplated to a base metal, usually Steel (but often Zinc, Brass or Copper).



Mostly, Nickeloid Metals are supplied in continuous coils in widths up to 24" for modern, low cost fabrication. They're also available in sheets and strips. Optional: bright or satin finishes, plating one or both sides, a galaxy of stunning patterns and crimps.

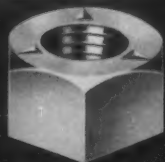


Quality plating produces metals so durable they can be fabricated, even quite severely drawn or bent. Rejects minimized. For severe stamping, we offer Mar-Not protective coating that is easily peeled off after its job is done.

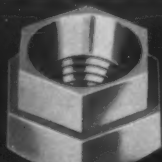
Which is your preference in modern metals — the clean, flint-hard gleam of Chromium, the warmth of Copper, or the rich radiance of polished Brass? No need to answer now, but consider the galaxy of wonderful products you find everywhere today that employ one of the Nickeloid Metals. These durable, lustrous finishes are not mere lily-gilding. In most instances they are designed *into* the product . . . functionally. We make a raw material that has been given these quality finishes the *automated* way . . . in giant coils in block-long mills. Nickeloid finishes are electroplated to the base metal *before* fabrication, a process as fundamental we believe as the coating of printing papers in rolls *before* they are printed. Three out of five costly manufacturing steps are by-passed. Write for our free Introductory Kit, which includes metal samples — learn the complete story.

AMERICAN NICKELOID COMPANY • PERU 9, ILLINOIS

America's Pioneer Manufacturer of Pre-Finished Metals — Since 1898



GRIPCO TOPLOCK NUT
One piece all metal.



GRIPCO CLINCH NUT
With or without self-locking threads. Hex collar prevents turning when torquing bolt.



GRIPCO PILOT-PROJECTION WELD NUT
With or without self-locking threads. Centering collar positions nut and protects threads from weld spatter.

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GRIPCO®

FASTENERS—

Service—40 sales representatives all over the country for prompt, fast service.

Reliability—Quality controlled by the oldest established lock nut manufacturer in the U.S.

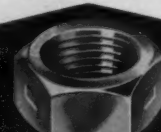
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- Cold formed special nuts or parts to print.

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GRIPCO CENTERLOCK NUT
Locking feature in the center for fast feeding. Can be applied from either end.



GRIPCO COUNTERSUNK WELD NUT
With or without self-locking threads. Countersink protects threads from weld spatter.

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Subsidiary of Heli-Coil Corporation,
Danbury, Conn.

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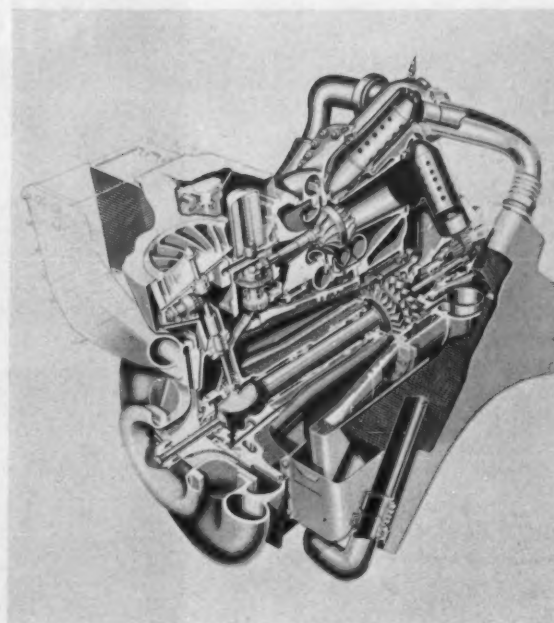
RELEASES...

• **TURBOCHARGED AUTOMOTIVE GAS TURBINE** consists of two compression stages with intercooling between them, primary and re-heat combustion chambers and a recuperator (heat exchanger) between the second stage of compression and the primary combustor. Overall pressure ratio is 16:1.

Each compressor stage effects a 4 to 1 air compression. The low-speed compressor turns at 46,500 rpm and the high speed at 91,500 rpm. The power turbine turns at 37,500 rpm and a planetary reduction gear is utilized to reduce the output shaft speed to 4600 rpm. The power turbine is located between the high-pressure turbine and the two supercharging or pressure turbines. This results in good part-load fuel economy.

Package size is approximately 38 inches long, 29 inches wide and 28 inches high. The turbine weighs 650 lb installed, complete with all accessories, and requires only the addition of electrical power and fuel lines. A diesel truck engine of comparable horsepower weighs about 2700 lb.

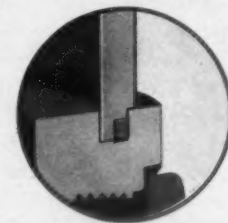
The turbocharged gas turbine was developed by the Ford Motor Co.



CUTAWAY VIEW of turbocharged gas turbine engine shows low-pressure compressor, lower center; and shaft leading back to twin turbine drive assembly, right center. Intercooler fan, upper left foreground; intercooler, extreme upper left; high-pressure compressor, turbine and accessory drive, upper center, are also shown.

RESISTINGEST BARREL SEAL

known to heat, corrosion, pressure, hydraulic fluids, and moisture: new white Teflon* barrel seal, now on Hydro-Line Series N2 hydraulic cylinders. Pressure-sensitive Teflon is chemically inert to hydraulic fluids . . . endures continuous temperatures up to 500° F. Leakproof seal compression is positive because barrel is supported radially. Barrel shoulders pilot into end caps. Even pressure surges cannot increase metal clearance. Series N2 cylinder bore sizes 1½" to 8" delivered off the shelf. Sizes 10", 12", and 14" also available. See *Sweet's Product Design File* for specifications and address of your Hydro-Line representative. Or, phone TR 7-5758.



*Teflon is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)

5603 PIKE ROAD, ROCKFORD, ILLINOIS, manufacturers of:
high- and low-pressure hydraulic cylinders • heavy-duty air cylinders • adjustable-stroke cylinders • dispensing cylinders • intensifiers • single-acting cylinders • boosters • rod end couplers

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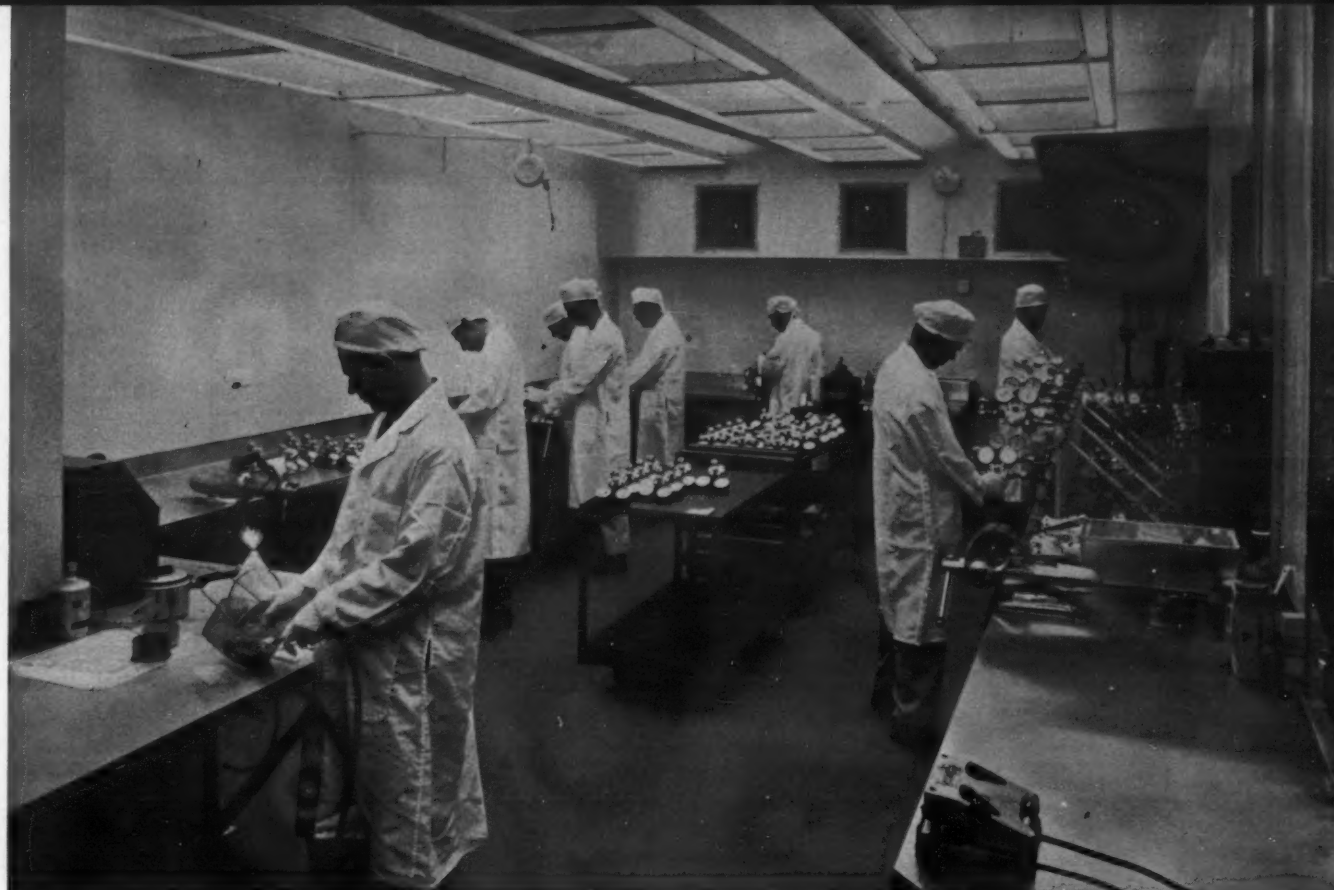
• **ELECTRIC STEERING ENGINE** for small boats, when coupled with an automatic pilot, gives the small boat operator all the advantages of automatic electric steering. The electric autopilot is designed for use in pleasure craft and small commercial craft.

The autopilot is installed without modification of the existing steering system. A dial is set to the desired course and the vessel turns to and holds to the selected heading.

The electric steering engine was developed by Sperry Piedmont Corp., Div. of Sperry Rand Corp., for use with Sperry's Automatic Pilot 6.

• **ANTENNA POSITION ENCODING SYSTEM** is expected to be used in radar and radio tracking of satellites, missiles and space vehicles. The system will include servo transmitters which will be attached to the axes of the antenna and a rack-mounted receiving unit from which the antenna angle in binary-coded decimal logic may be obtained. Two shaft position encoders (one for each axis) will be used. Each encoder will provide a digital output from 0 to 89.995 deg per 90 deg of angular rotation. The system will provide an rms accuracy of 20 sec of arc, resolution of 0.005 deg, maximum readout speed of 3 deg per sec maximum antenna speed and permit unlimited readout cycles.

The antenna positioning encoder system will be designed and built by Datex Corp. under a contract with Collins Radio Co.

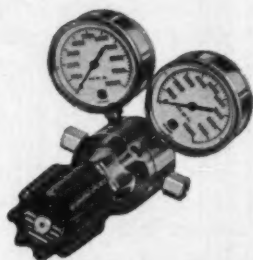


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Control gases safely and accurately to 10,000 psig.

Victor high pressure gas regulators are cleaned, assembled, tested and packaged under carefully controlled conditions to insure maximum product reliability. Cleaning is performed to Victor standard or to customer specifications in a room approved by industry

and military agencies. Regulators shown here are typical of the available models covering a range of pressures to 10,000 psig. and capacities of 80,000 scfm. at -67° F. to $+250^{\circ}$ F. Write for Regulator Inquiry Form 361B and regulator bulletins.



GD700 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Pilot operated—low torque
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 250 scfm.
Panel Mounting



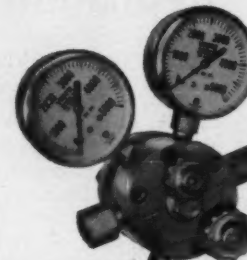
GD40, GD90, GD100, GD200 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Remote or integral controlled
Inlet to 6,000 psig.
Outlet to 6,000 psig.
Flows to 80,000 scfm.
Panel mounting if desired.



LR SERIES LOADER REGULATORS
BPR SERIES BACK PRESSURE
REGULATORS

Bronze or stainless steel
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 10 scfm.
Low operating torque:
40 inch lbs. at 7,000 psig.
60 inch lbs. at 10,000 psig.
Panel mounting.



GD60 AND GD80 SERIES
GAS-O-DOME REGULATORS

Bronze or stainless steel
Remote or integral controlled
Inlet to 10,000 psig.
Outlet to 10,000 psig.
Flows to 2,000 scfm.
Panel mounting if desired.



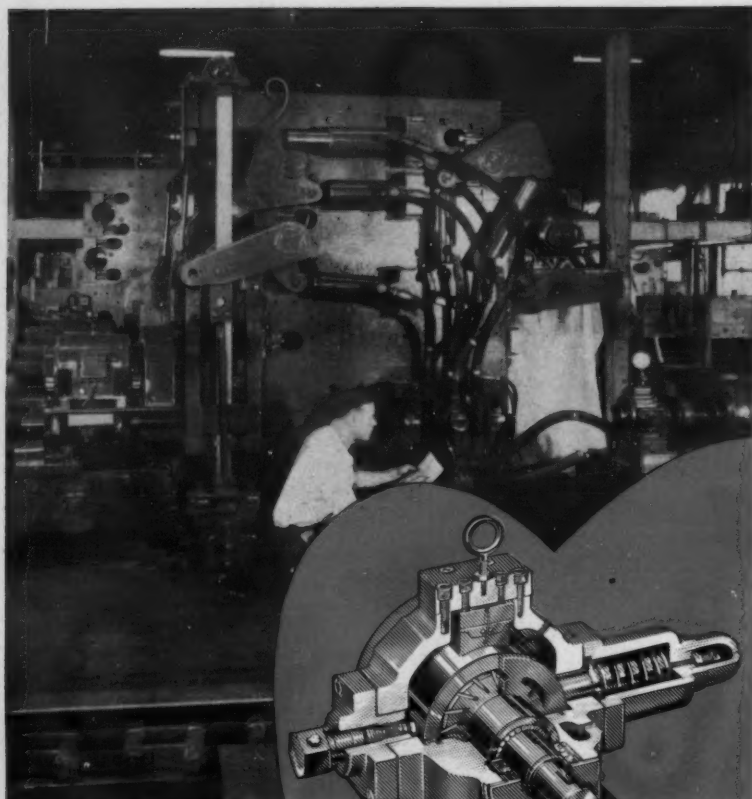
VICTOR EQUIPMENT COMPANY

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1145 E. 76th St., Chicago 19
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SUPER TRUSTEE CONCRETE BLOCK MACHINE BUILT BY THE GENE OLSEN CORP., ADRIAN, MICHIGAN

This dependable hydraulic heart

REDUCES UPKEEP AND DOWNTIME BY AS MUCH AS 80%

"RACINE HYDRAULIC EQUIPMENT is the heart of our concrete block machines," says C. S. DeLamater, sales manager for The Gene Olsen Corp., another satisfied user of RACINE PUMPS and VALVES exclusively since 1949. Besides the tremendous savings in operating hydraulically-designed concrete block machinery, the firm emphasizes the advantage of simplified control of oil circulation in RACINE VARIABLE VOLUME PUMPS. They pump only the oil required to do the job — no waste of pressure oil — no heating. Thus through lower horsepower, operation economies are enjoyed.



Racine Hydraulics & Machinery, Inc.
RACINE, WISCONSIN
HYDRAULICS DIVISION

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The heart of this 1100 blocks per hour concrete block machine is a RACINE MODEL 8R PUMP

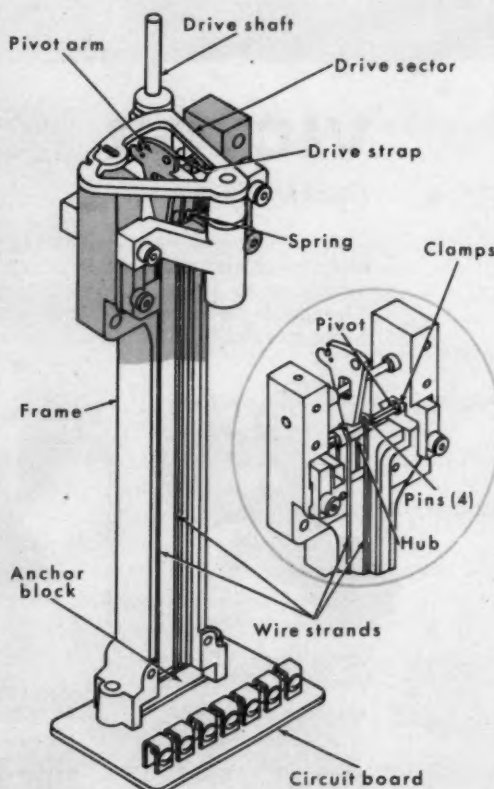
RELEASES...

• **INDUSTRIAL PROCESS POTENTIOMETER** incorporates an extremely accurate electro-mechanical strain gage as the rebalancing element. In eliminating the conventional slidewire, long an objective of instrumentation engineers, infinite resolution is achieved.

The rebalancing mechanism, or "Stranducer", varies the output potential of the measuring circuit to balance the input signal from the process variable. It is enclosed in an I-shaped frame which supports and anchors internal components.

Four looped-wire strands form the variable resistance legs (Wheatstone bridge) of the measuring circuit. These are attached to an insulated block at the I-frame base which, in turn, acts as a heat sink. Free ends of the wires are soldered to the Stranducer terminal board.

The upper section of the I-frame houses a horizontal torsion pivot which provides a true turning radius for precise operation. The cen-



STRANDUCER controls magnitude and polarity of feedback voltage of measuring circuit and is linked mechanically through sector and strap reduction stages and drive cable to balancing motor. Electrical connections are through terminal board.

PRESIDENT



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who first put Luster-On®
on the job!**

Luster-On is The Chemical Corporation's low-cost protective finish for aluminum, brass, cadmium, copper or zinc. It is supplied in a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in a single, simple, economical operation. Available as a liquid or powder for immediate delivery.

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FOR BRILLIANT CORROSION-RESISTANT FINISHES... rivals even chrome in many instances where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT AND IRESCENT COATINGS... imparts striking, attractive appearance with complete corrosion protection, even when humidity and handling are encountered during processing. Also available are yellow iridescent and olive drab for concealed parts or as a paint bond.

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FOR ALUMINUM... replaces expensive anodizing where surface hardness is not of prime importance. An excellent finish for paint bonding.

FOR LASTING BRIGHTNESS... on both copper and brass without noxious fuming.

FOR DIE-CASTINGS... one quick dip provides uniform finish; superb as a base for painting.

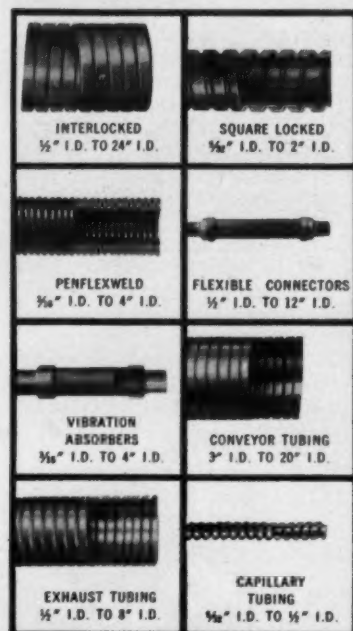
See for yourself what Luster-On can do for you! Send us a sample part — now — for free processing. Data sheets on request.

Luster-On — first and still the finest in conversion coatings.

The **Chemical Corporation**

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FLEXIBILITY
PENFLEX HAS IT!



COMPLETE LINE OF JOB-PROVED FLEXIBLE METALLIC TUBING

When your new product requires flexibility in conveying air, water, steam, gases, volatiles, granular, abrasive or light solid materials, specify Penflex. It's the flexible metallic tubing with complete engineering service from design board to the job installation.

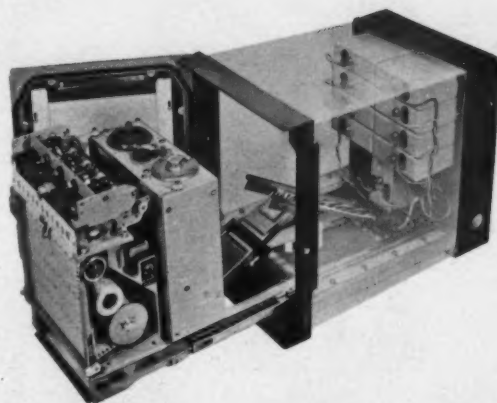
Penflex offers a complete line of all types and sizes of flexible metallic tubing. Corrugated and interlocked, steel, stainless steel, or bronze in sizes from 1/8" I.D. to 24" I.D. . . . rugged, safe to withstand pressures and high temperatures. Write for data application book on flexible tubing to

Pennsylvania Flexible
Metallic Tubing Co.,
Paoli, Pa.



TIGHT AS A PIPE BUT FLEXIBLE

Circle 226 on Reader-Service Card



INSTRUMENT can be mounted in standard 19-inch relay rack. Strip chart model shows display, drive and case modules; can be quickly converted to circular chart recorder or circular scale indicator.

tral proportion of the pivot consists of a hub over which the four wires are looped. An arm attached to this hub is driven by a cable linked mechanically to the balancing motor through two stages of drum and sector reductions.

Drum and sector are kept under tension at all times by the torsional force of the pivot and an additional spring. Any change in position of the balancing motor causes torsional movement of the pivot.

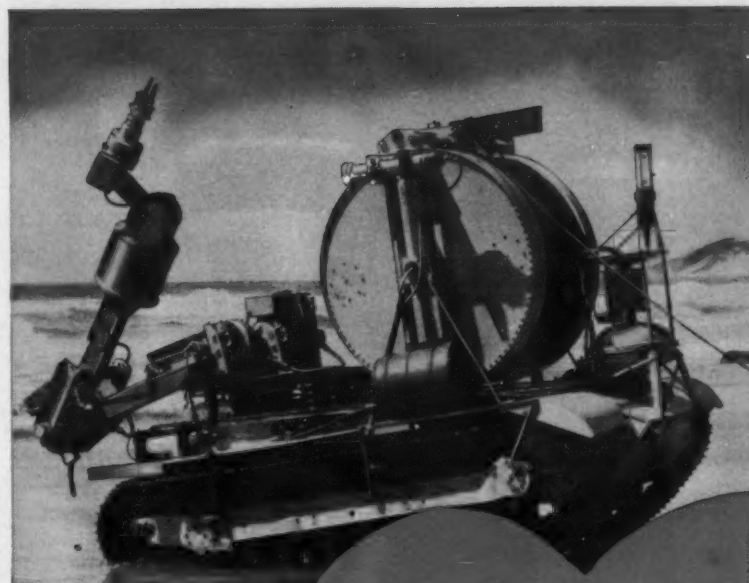
Thus, a change in input to the potentiometer drives the motor in one direction or the other, increasing tension on two of the Stranducer wires while decreasing it on the other two wires. This changes the electrical resistance of the wires and continues to change it until the bridge is rebalanced electrically. At this point, the motor stops moving.

Movement of the wires, which act like rubber bands, is extremely slight but precisely proportional to the degree of shaft rotation. A pen carriage of the potentiometer is linked to the balancing motor and the same movement that balances the bridge also positions the pen or indicator.

An amplifying system provides critical damping and optimum response for high-impedance actuations. The thermally compensated electrical network minimizes zero shift caused by temperature change with a cascaded Zener diode network providing a constant current to the measuring circuit and eliminating need for periodic standardization.

Calibrated accuracy is 1/4 percent. Initial production of the potentiometer will consist of single pen strip and circular chart recorders and a circular scale indicator, each with or without control.

The instrument, called the ElectronK 17, has been introduced by Brown Instruments Div., Minneapolis-Honeywell Regulator Co.



REMOTE UNDERWATER MANIPULATOR BUILT FOR THE U.S. NAVY BY THE SCRIPPS INSTITUTION OF OCEANOGRAPHY OF THE UNIVERSITY OF CALIFORNIA AND THE HUDSON LABORATORIES OF COLUMBIA UNIVERSITY.

**This hardy
HYDRAULIC
HEART operates
efficiently even
20,000 ft.
under water**

*The Heart of this
Exotic Ocean Explorer
Is a RACINE
MODEL DS PUMP*

A RACINE pump actuates the mechanical arm on the Remote Underwater Manipulator, a new experimental vehicle the U.S. Navy uses to explore the ocean floor down to depths of 20,000 ft. The arm makes all the motions of the human arm and hand. It picks up samples from the ocean floor . . . assembles and installs instruments in the ocean depth. Land-based remote controls operate the underwater explorer. Rated at 1,000 psi continuous pressure, the RACINE pump automatically compensates for the compressibility of oil under various sea water pressures. When you need versatile hydraulic components—sturdy and dependable for any use from research to assembly line—your best choice is RACINE!

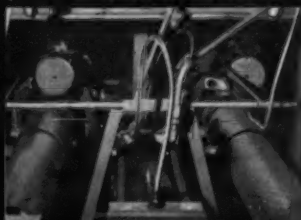


Racine Hydraulics & Machinery, Inc.
RACINE, WISCONSIN
HYDRAULICS DIVISION

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**Where
actuating control
and precision
are paramount**

**—like in a giant
supersonic
wind tunnel**



**—or a precision
machine tool**



**you'll find
"BEAVERS"**

BEAVER ball screws are specified by engineers around the world for control of motion. Compressing solid steel wind tunnel walls, 1600 feet square against inconceivable pressures and holding error to .008" in an 8 foot stroke—or extreme accurate 3 dimension positioning of numerically controlled machine tool are all "naturals" for this equipment.

Can your product be
made more efficient
with Beaver Ball Screws?
Write for literature.

**Beaver
Precision
Products
INC.
CLAWSON, MICH.**

Circle 228 on Reader-Service Card

PLANS AND CROSS-SECTIONS

Merrily We Roll Along . . .

A high-speed electric highway system may someday whisk rapid transit commuters to and from work. The system, described as a Roller-Road, would consist of a series of rubber rollers, similar to inverted roller skates, spaced 20 ft apart and built on the ground. The rollers would be powered by small individual motors. Flat-bottomed carriers for the automobiles would be supported and propelled by the rubber rollers. Guide rails on either side of the Roller-

Road would steer the carriers along the rollers.

The Roller-Road was invented by two Westinghouse Electric Corp. engineers, Charles Kerr, Jr., and Clarence Lynn, and was recommended as a possible solution to the interurban transportation problem by Dr. Lawrence R. Hafstad, General Motors' vice president and director of research, to the 40th annual meeting of the Highway Research Board.



Ancient Glass? Count the Crusts

The age of ancient glass can now be measured by countings rings in its weathered crust.

Dr. Robert H. Brill of the Corning Museum of Glass and Harrison P. Hook of Corning Glass Works developed the new dating method.

When objects of glass are buried in soil for a long time or submerged under water, they often undergo a slow chemical deterioration that produces a surface crust. This is comparable to the rusting of metal objects but takes place at a much slower rate.

When the weathering crust, generally one to two millimeters thick, is examined in cross-section under a microscope, tiny separated layers can be observed. These layers are so thin that about 30 of them would have to be stacked to make the thickness of a human hair.

The scientists assume on the basis of

good chemical evidence that a single layer is the result of one year's decomposition. The length of time the glass has been buried can be determined by counting the layers.

The method is similar to the counting of tree rings to measure a tree's age, except that the glass-age method involves a destructive process rather than a process of growth.

Validity of the method was tested by counting layers in weathering crust from objects buried for a known period of time.

The oldest object yet studied was a fragment found in the ruins of the ancient city of Sardis, Turkey. The building where it was found is believed to have been built in the late third century and was probably destroyed early in the seventh century. The ring-counting technique indicated the fragment was buried about 378 A.D., \pm ten years.

BEAVER BALL SCREWS

Successor to the Acme screw drive and preferred in many applications to hydraulic and pneumatic systems. Guaranteed 90% efficient in converting rotary twist to linear push (or vice versa). Employs a stream of precision balls and ground lead to eliminate drag and wear in delicate instruments, aircraft, machine tools, massive wind tunnel jacks, etc. For horizontal and vertical actions, indexing, inching and traversing. Consultation and engineering service available. Write for literature.



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• ANY DIAMETER OR TRAVEL • RAPID START • NO BACKLASH • EXTREME ACCURATE POSITIONING •



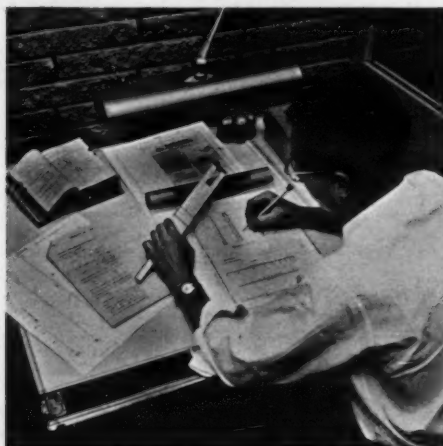
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CHIKSAN
LFS SERIES
SWIVEL JOINTS
Rated — 500 psi CWP

- Equally effective on water, hydraulics, fuels or gas lines. Sweep radius minimizes flow turbulence. Bearings are factory lubricated—sufficient, in normal services for the life of the joint. Fabricated from carbon steel. Temperature rating of 225°F—up to 400°F with Viton A packing. Size range is 1½" to 4". For more information, request Bulletin 11-60.

CHIKSAN COMPANY BREA, CALIF. 61-58 A

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Effective Communication...



Illustrating

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DESIGN DATA
NEWS

IN BRIEF

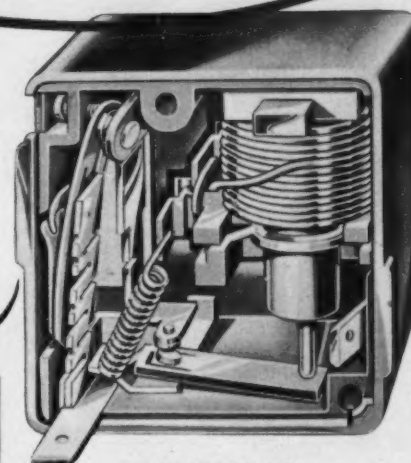
• **ELECTROSTATICS**, dating back to the early days of Greek history, may go far in the Space Age. Goodrich-High Voltage Astronautics, Inc., Burlington, Mass., recently announced receipt of Air Force contracts under which the company will develop and fabricate a demonstration model ion propulsion engine and an electrostatic generator which could be used to power such an engine on a space vehicle. Prime energy for the generator in the space vehicle would likely come from a nuclear source. The GHVA engine will illustrate propulsion feasibility and principles of operation which may propel vehicles through space with the speed and efficiency needed for interplanetary exploration—speeds of up to and beyond 100,000 miles an hour.

• **TWENTY-EIGHT GAGE MAGNUM** shotshell with one full ounce of either No. 6, 7½, 8 or 9 shot has been announced by Winchester-Western Div. of Olin Mathieson Chemical Corp. Designed to bring the 28-gage shotshell up to the level of standard 20-gage shot weight, the 2¾-inch Magnum 1-oz loads will be available in both Winchester Super-Speed and Western Super-X shotshells. The 28-gage is a small bore suitable for both youthful shooters using their first shotgun and hunters who prefer the fast-handling characteristics of the lighter models. The 28-gage is used for partridge, quail, dove and shorebird shooting.

Chace THERMOSTATIC BIMETAL

ACTUATES ANOTHER PRECISION PRODUCT...

Ranco® COMBINATION STARTING RELAY AND OVERLOAD PROTECTOR



A PRODUCT OF
RANCO INCORPORATED
COLUMBUS 1, OHIO

Flexibility of design in this fine Ranco product — Ranco Type H60 combination motor starting relay and overload protector — produces three results of utmost importance to refrigerator manufacturers:

1. Provides better motor protection.
2. Allows increased compressor capacity.
3. Assures dependable starting.

The Ranco H60 plugs directly onto the three terminal pin cluster of hermetic refrigerator compressors. It can be provided with a variety of terminals and covers for both screw type and quick connect line terminals. A horsepower range from 1/3 HP, 115 Volts to 1/12 HP, 230 Volts is possible.

The overload protector here is of the "Inherent" type and decides how much load the motor should accept (cool motor, high current; warm motor, low current). The "deciding" in the Ranco Combination Starting Relay and Overload Protector is done by dependable Chace Thermostatic Bimetal.

The flexibility of design and wide horsepower range of this Ranco product are provided through the use of several bimetal shapes and more than two dozen different types and thicknesses of Chace Thermostatic Bimetal. Ranco uses one word to describe Chace Thermostatic Bimetal: "dependable." This has been Chace's specialty for more than a third of a century... dependable, precision thermostatic bimetal. Hundreds of manufacturers depend on Chace Thermostatic Bimetal... they know their good names are safe on the outside with Chace Thermostatic Bimetal on the inside of their products.

SEND NOW FOR OUR NEW "INFORMATION BOOKLET!" It contains many well illustrated pages of valuable design data and examples of successful applications of bimetal. More than 40 types of Chace Thermostatic Bimetal are available in coils, strips and completely fabricated elements of your design.

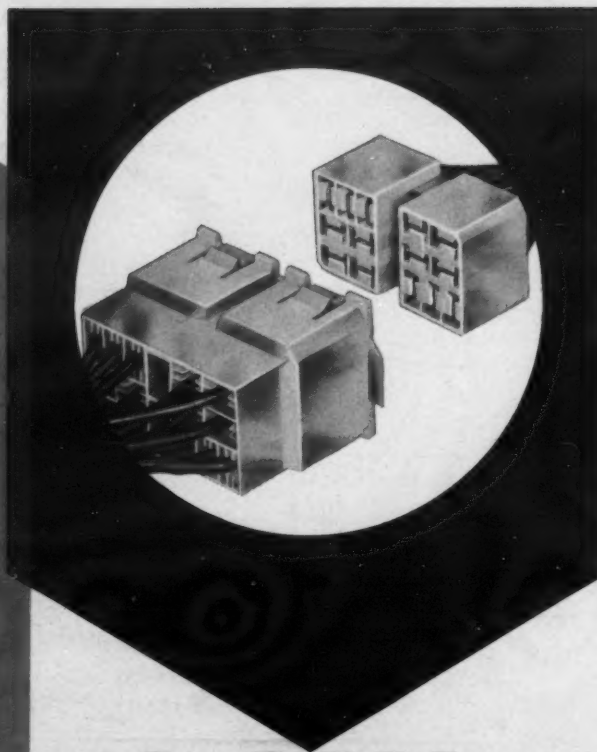
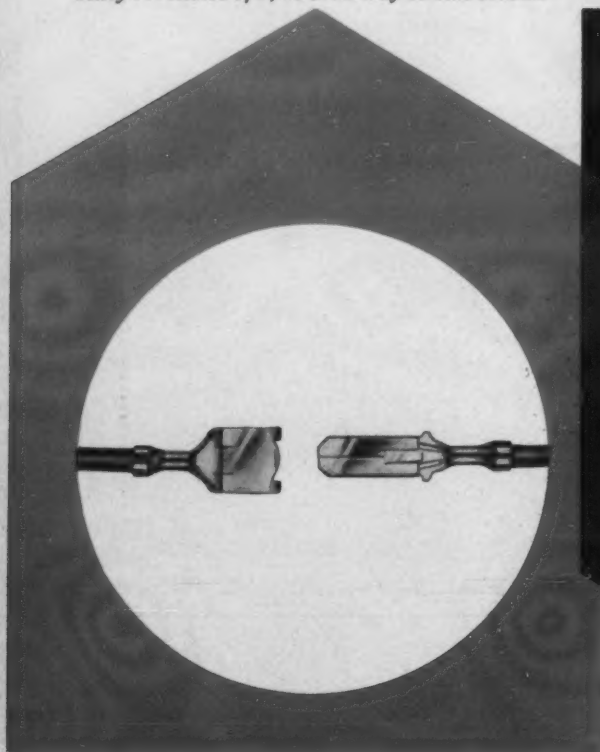


W. M. CHACE CO.
Thermostatic Bimetal
1612 BEARD AVE., DETROIT 9, MICH.

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HIGH

20-25 amperage rating for greater design flexibility... choice of 7, 14 or 20 way circuit blocks.



LOW

2-5 pounds insertion and extraction force for easier installation and servicing.

NEW AMPEEZ CONNECTOR GIVES YOU BOTH

Here is a workhorse of a connector! Housed in tough nylon and designed to carry as many as 20-circuits while holding insertion-extraction forces to 2-5 pounds, AMPEEZ Connectors are adaptable to many applications calling for a heavy-duty, easily serviced multiple-circuit disconnect.

AMPEEZ Connectors will match your application needs perfectly... anything you call for up to 20-circuits and 25 amps. One other major feature! AMP's exclusive *Tab-Gap Lok* assures a constant contact pressure even under the severest vibration conditions.

Use AMPEEZ Connectors, eliminate the human error in individual connections... make them fast and safe. Send today for AMPEEZ Connector literature and sample of tab and receptacle with Tab-Gap Lok.

AMP INCORPORATED

GENERAL OFFICES: HARRISBURG, PENNSYLVANIA

AMP products and engineering assistance are available through subsidiary companies in: Australia • Canada • England • France • Holland • Italy • Japan • West Germany

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IN BRIEF...

SPACE VEHICLES in orbit as of Jan. 13, 1961:

Name/Country	Launch Date	Transmitting
Explorer I (US)	Jan. 31, 1958	No
Vanguard I (US)	Mar. 17, 1958	Yes
Lunik I (USSR)*	Jan. 2, 1959	No
Vanguard II (US)	Feb. 17, 1959	No
Pioneer IV (US)*	Mar. 3, 1959	No
Explorer VI (US)	Aug. 7, 1959	No
Vanguard III (US)	Sept. 18, 1959	No
Explorer VII (US)	Oct. 13, 1959	Yes
Pioneer V (US)*	Mar. 11, 1960	No
Tiros I (US)	Apr. 1, 1960	Yes
Transit I-B (US)	Apr. 13, 1960	No
Spacecraft I (USSR)	May 15, 1960	No
Midas II (US)	May 24, 1960	Yes
Transit II-A (US)	June 22, 1960	Yes
NRL Satellite (US)	June 22, 1960	Yes
Echo I (US)	Aug. 12, 1960	Yes
Courier I-B (US)	Oct. 4, 1960	Yes
Explorer VIII (US)	Nov. 3, 1960	No
Tiros II (US)	Nov. 23, 1960	Yes
Discoverer XIX (US)	Dec. 20, 1960	No

*In solar orbit; others in earth orbit.

• **HOMING ABILITY IN BATS** is the subject of research being conducted by Russell P. Davis, graduate assistant in the University of Arizona's Dept. of Zoology. "Eight returns by the same bat from nine different points in Arizona and New Mexico is the best record to date," Davis said. Home base for the bats is a bridge near St. David, Ariz. Davis began the study in May 1960.

Meetings

Denver, Colo. Feb. 24-25	ANNUAL CONVENTION, Colorado Society of Engineers, Denver Hilton Hotel.
Los Angeles, Calif. Feb. 27-Mar. 1	MEETING of the Association of Iron and Steel Engineers, Hotel Statler.
Cleveland, Ohio March	FLIGHT PROPULSION MEETING, Institute of the Aeronautical Sciences.
Washington, D. C. Mar. 5-9	DIVISION CONFERENCE, Gas Turbine Power, American Society of Mechanical Engineers, Shoreham Hotel.
Los Angeles, Calif. Mar. 12-16	AVIATION CONFERENCE, American Society of Mechanical Engineers.

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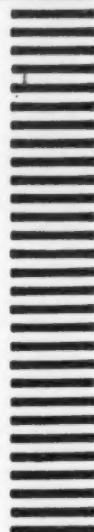
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CLEVELAND: D. R. Buckner, 11955 Shaker Blvd., Cleveland 20, Ohio. SWeeetbriar 1-5414.

Pittsburgh District Office: One Gateway Center, Pittsburgh 22, Pa. ATLantic 1-8822.

DENVER: Executive Offices. 3375 S. Bannock, Englewood, Colo. SUNset 9-0571.

DETROIT: J. V. Carey, M. E. McKibben, Jr., 19600 W. McNichols Rd., Detroit 19, Mich. KENwood 7-3740.

LOS ANGELES: R. C. Wynkoop, A. H. Parkes, 6399 Wilshire Blvd., Los Angeles 48, Calif. OLive 3-9720.

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BUSINESS STAFF

J. C. Crawford... Manager of Sales Promotion
R. W. Rice... Advertising Services Manager
R. K. Kinnes... Manager, Circulation Services
3375 S. Bannock St., Englewood, Colo.

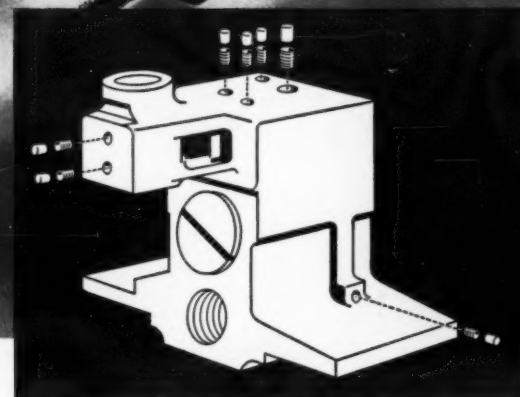
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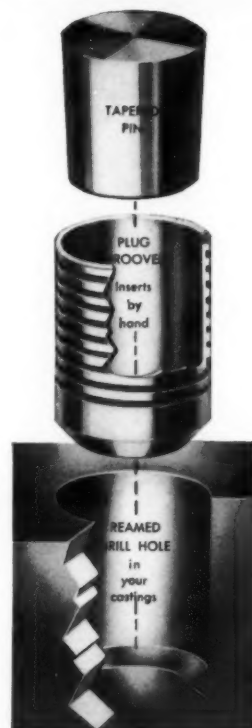
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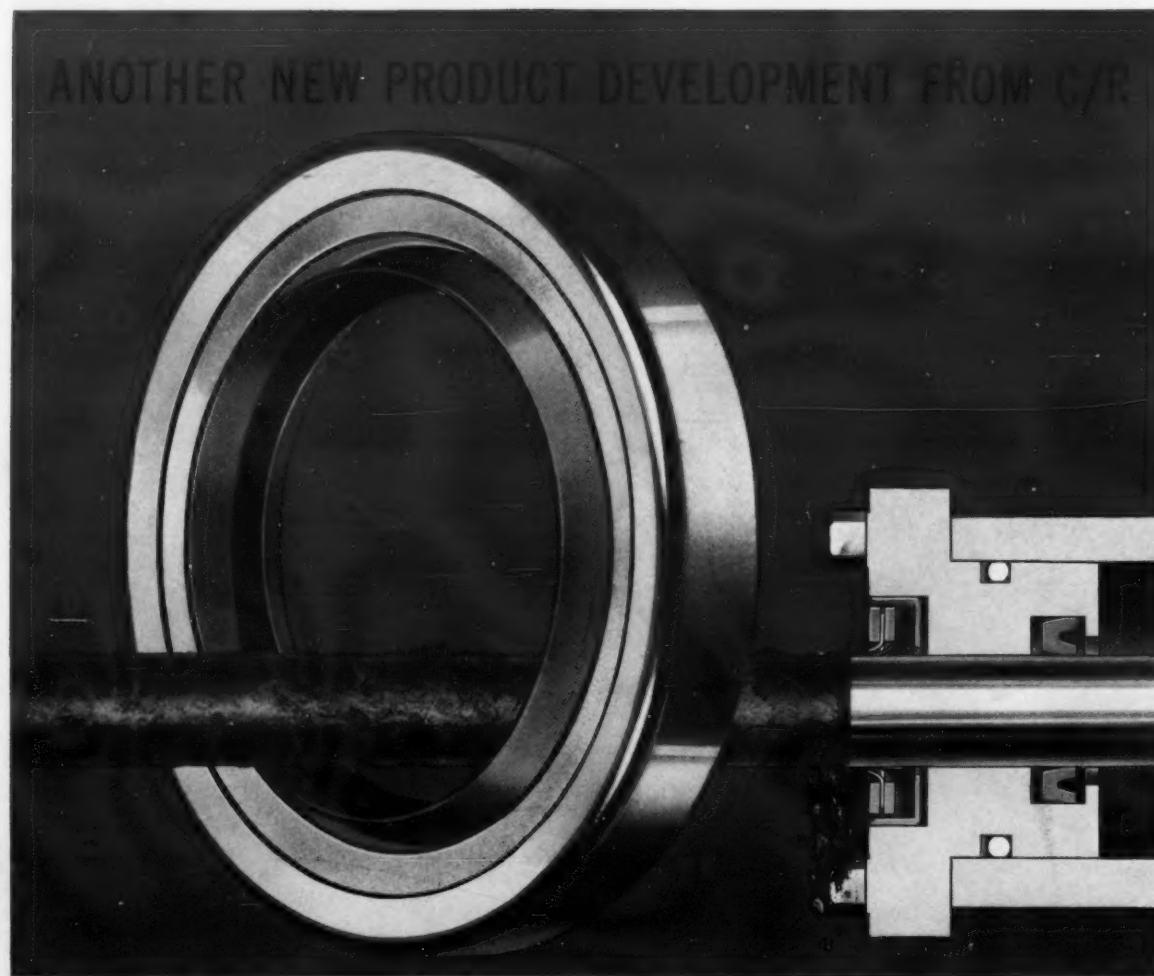
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